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EXCHANGES.

[Exchange notices (not over five lines) inserted free for subscribers. Notices will be inserted in the order in which they are received, and those at the top of the column will be removed only when it is necessary to make room for new ones at the bottom]

AMARA. Being engaged in the study of this genus, I will determine specimens for collectors. These should be sent numbered. I am also anxious to obtain species in other genera of Carabidae not in my collection, from all parts of the world, and will purchase or exchange for same. Roland Hayward, Readville, Mass.

WANTED—Eggs, larvae or pupae of grasshoppers, dragon-flies, beetles, bugs, etc. Will give tropical butterflies in exchange. Denton Bros., Wellesley, Mass.

WANTED—Material for the study of the hybrid or polymorphic butterflies of the genus *Basilarchia*, including larvae or pupae of *arthemis* or *astyanax*, imagos of *proserpina* or *arthechippus* or any specimens showing unusual characters. Liberal exchange. Specimens retained will be deposited in Museum of Comparative Zoology. W. L. W. Field, Milton, Mass.

LEPIDOPTERA—For exchange, fertile eggs of *Hemileuca maia*. Alfred C. Sampson, Sharon, Mass.

I have a few specimens of *C. calleta* and *cinctus* to exchange for rare *Sphingidae* or Pupae of same. W. T. Buxton, 17 Walter St., Somerville, Mass.

WANTED—Ova, larvae or pupae of *Limenitis ursula* and *arthemis*. Will give cash or exchange. H. H. Newcomb, 35 Court St., Boston, Mass.

Will collect Diptera, Hymenoptera, Hemiptera and Coleoptera. Would like in exchange, quantities of named or unnamed Buprestidae, Scarabaeidae, Cerambycidae and Chrysomelidae. Please write immediately to G. Chagnon, P. O. Box 186, Montreal, Canada.

Correspondence desired regarding Rhopalocera of North and South America, especially Argynnis, Papilio, Morpho, Caligo. Exchange or otherwise. T. H. Shepherd, 15 Hope View, Carr Lane, Shipley, Yorks., England.

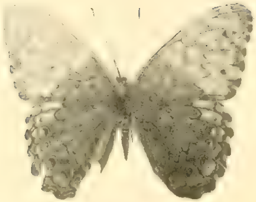

Fig. 1. Type of *Amphichlora poseidon* n. sp., from El Valle, Margarita Island, Venezuela.

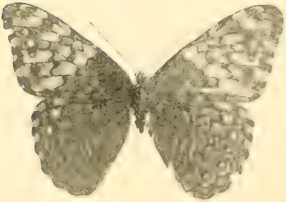

Fig. 2. *Amphiclora ferentina* Godt., from same locality, taken at same time.

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NOTES ON THE BUTTERFLIES OF MARGARITA ISLAND, CARACAS, AND CARUPANO, VENEZUELA.

BY AUSTIN H. CLARK, BOSTON, MASS.

In 'The Ibis' for January, 1895, Dr. P. L. Sclater suggested to ornithologists the advisability of turning their attention to the Island of Margarita as a field hitherto unworked. As a result of this notice, Captain Wirt Robinson, U. S. A., visited this locality in the summer of 1895, bringing back an extensive collection of the birds of the island, a number of insects, and some mammals. Unfortunately, the butterflies were subsequently lost; but on working up the mammals and birds, no less than thirteen new species were discovered, two of the former, and eleven of the latter.

Having determined to spend the summer of 1901 in zoölogical investigation in some little known part of South America, I communicated with Captain Robinson, with the result that I decided to visit this locality, and make a study of its fauna, as complete as time would allow, to form a sort of supplement to his work.

Accordingly, on the 15th. day of June, 1901, I left New York for La Guaira, en route for Margarita. At La Guaira I stayed a day and a half, leaving there for the more pleasant city of Caracas, to await the arrival of the steamer which was to take me to Carupano. During my stay of about a week at Caracas, I made daily excursions into the surrounding country for insects; but a combination of circumstances prevented my making any captures while at La Guaira. At Carupano also, while hunting up a small boat in which to make the journey across the channel, I could not spare any time for collecting, but on my way back I obtained a few specimens here.

Reaching Porlamar, on the southern shore of the island, on July 3rd., I at once proceeded to the little town of El Valle, situated about three miles from the sea, in a pleasant valley at the foot of the central mountain. This village is partially surrounded by groves of cocoanut palms, and is a very convenient place of residence, the climatic conditions being much more agreeable than in the towns nearer the coast, while it is easy of access both to the hot country near Porlamar, and the mountain forest. The region is peculiarly heathful, and too much cannot be said of its inhabitants, who seem to consider it an honor to assist the collector in every way. In this town I resided until July 25th., when circumstances compelled me to leave suddenly, much against my will, as my collections were as yet far from complete. During my stay, however, I secured specimens of all the butterflies observed, with the exception of a *Morpho*, an *Opsiphanes* (?), a *Papilio*, a *Urania*, and *Colaenis julia*; but I am confident that more extended researches, over parts of the island which I was unable to visit, will bring to light many additions to the following list, and it is much to be desired that sometime in the future, others, profiting by the experience of Captain Robinson and myself, will visit this interesting locality and make a much more exhaustive report on its entomological fauna.

The island of Margarita is situated midway between La Guaira and Trinidad, directly north of the town of Cumana, being about seventeen miles distant from the nearest point of the mainland. Its greatest length from east to west is forty-two miles. It consists of two portions, joined by a narrow swampy isthmus of about twelve miles in length, the eastern part being the larger, in the shape, roughly, of a pentagon, some twenty miles across, while the western is an irregular quadrangle, twelve miles long by nine in width. In the eastern part there is a mountain of 3,240 feet altitude, thickly wooded almost to the base; in the western another rises to the height of 2,300 feet, but is practically barren.* At the time of my visit the only way of reaching the island was to take a small trading vessel from Carupano or Cumana, which ports could be easily reached by the boats of the French or Dutch West India Mail. Now, however, the boats of the Royal Mail Steam Packet Company, plying fortnightly between Barbados and La Guaira call in at both Carupano and Porlamar, Margarita.

Margarita is divisible into three well defined life zones, as follows:

I. The almost flat costal plain, which extends all about the island occupying a strip averaging two or three miles in width, hot and sandy, supporting only a very scanty vegetation, which consists of post and melon cactus, with patches of "tuna,"** and scattering thorn-trees. I saw no butterflies whatever in this region; but among birds the burrowing owls *(Speotyto)* are exclusively found here, and the troupial *(Icterus)*, scaled Dove *(Scardafella)* Buzzard *(Buteo)*, and parrakeet *(Conurus)* prefer it to any other. Here also I found the trail of a rattle-snake *(Crotalus)* which appears to be quite rare, as all the natives assured me that they never had seen a snake on the island, and I found no trace of others in all my wanderings. The armadillo is reported to occur in this district.

II. The intermediate zone, consisting of a rough hilly country, with a large amount of scrubby growth, and many varieties of cacti, including also the cassava plantations. Here the specimens of *Apodemia* were taken, and a single *Urainia* was observed. The birds characterizing this region are the Spine-tail *(Synallaxis,)* the cuckoos *(Diplopterus)* and the honey creepers *(Coereba)*; while among mammals the rabbit *(Lepus)* is practically confined to it.

---

* A map of the island was published in the Proceedings U. S. National Museum, XVIII, pl. XXXIII.

**A small, long-spined prickly pear, *Opuntia tuna*.

III. The forest region, including the whole of the mountain proper, and the valley in which the little town of El Valle is situated. This is, entomologically, divisible into three sub-regions, thus:

(a). The forest proper, including the greater part of the mountain. This, again is divisible into the drier portions, and the moist areas, in the immediate vicinity of water. Of the drier parts, the genus *Morpho* is the charactistic feature, which in the neighborhood of streams occur such forms as *Ithomia* and *Eurema albula*, and, in the lower portions, *Heliconius*.

(b). The intermediate forest region; where the little stream known as "El Rio," hardly more than a brook at the time of my visit, emerges from the thickly wooded area. This sub-region is the home of *Amphichlora poseidon* (see below), and in it *Heliconius melpomene* is found in greatest abundance.

(c). The valley region; consisting of cleared land with groves of cocoanut palms, interspersed with grassy patches, and the wooded borders of the river bed, which, at this season, is wholly without water. Here occur in abundance practially all the Pieridæ and Hesperidæ of the island, and such genera as *Eubagis*, *Agraulis*, *Lycaena*, *Euptychia*, *Mestra*, *Thecla*, *Anosia*, and *Amphichlora (ferentina)*. It was in this region that I saw the only specimens of *Papilio*, *Colaenis*, and *Opsiphanes* observed.

The whole fauna of Margarita is derived, as is that of the island of Trinidad, from South America, no purely West Indian forms being present, so far as known, among the birds, mammals, fresh-water fishes, or Lepidoptera. In fact, among the birds there seems to be a regular migration between the island and the mainland in the case of certain species (as the parrakeet); and I have seen numbers of Pieridæ *(Aphrissa, Phoebis, Callidryas)* in the channel, midway between the island and the Venezuelan shore.

The summer of 1901 was very dry* on Margarita, due to the partial failure of the spring rains. This may in some degree account for the paucity of the lepidopterous fauna, as represented by my collection. But it is true, without doubt, that there are many species, either local or erratic in occurence, which cannot be obtained except by a long residence in the locality. Captain Robinson has sent me a partial list of the lepidoptera he collected here. It contains ten species, only two of which are represented in my lot, which brings out graphically the difficulty of obtaining a complete list of the butterflies and moths of any given locality in the tropics.

---

*While in Barbados, in January, 1904, Mr. L. T. Spencer, F. R. G. S., who has lately spent considerable time on Margarita, informed me that water was now scarcer than ever; so much so indeed that the English pearl fisheries company at Porlamar were forced to depend on distilled sea water. The cutting down of the forests to build ships is without doubt the cause of this, as it is on the English West Indian island of Carriacou.

PAPILIONIDÆ.

Papilio thoas Linn.

On Margarita I saw a butterfly apparently referable to this common species, although much below the average size, which I was unable to capture, owing to the nature of the vegetation. Captain Robinson writes me that he collected here an undescribed dwarf variety of this insect.

PIERIDAE.

While approaching the coast of Venezuela, I saw large numbers of Pieridæ, flying over the water in small scattered groups. On the mountain sides above La Guaira I observed thousands of these insects, all moving, as were those over the water, toward the east. On the way from La Guaira to Caracas, as well as on the mountain slopes in the vicinity of the latter city, they could be counted by hundreds, all, without exception, moving toward the east.* It seemed to be a migration, which was following the line of the coast, and going in the general direction whence came the trade winds.**

Leptalis sp.

An undescribable species of this genus was collected by Captain Robinson on the island, but subsequently lost.

Pontia monuste Linn.

The most abundant butterfly on Margarita; it occurs in the cocoanut groves, and especially in the patches of rank grass about El Valle. The majority of the examples were in worn condition. In the early morning it is commonly found clinging to the grass-blades and leaves, where it is a conspicuous object.

---

*Mr. W. E. Broadway, Curator of the Botanic Station at Grenada, B. W. I., who lived for many years in Trinidad and who is an enthusiastic entomologist, tells me that *Urainia leilus* visits Trinidad every year from the mainland, coming over by hundreds, its movements being apparently comparable to those here described as observed among the Pieridæ.

**For a more detailed account, see Canadian Entomologist, Aug., 1903, p. 219.

Callidryas eubule Linn.

Common on Margarita.

Aphrissa statira Cramer.

Common, but not so much so as *Callidryas eubule.*

Phoebis argante Fabr.

Common at El Valle, associating with *C. eubule* and *A. statira.*

Gonepteryx clorinde Godt.

Occurred about El Valle, but was not abundant.

Kricogonia lyside Godt.

Two examples, a male and a female, taken near El Valle.

Pyrisita proterpia Fabr.

Obtained by Captain Robinson.

Pyrisita gratiosa Doubl. & Hew.

Four specimens obtained near El Valle. They are all paler than that figured by Doubleday and Hewitson, and than others from Central America which I have examined.

Eurema limbia Felder.

Fairly common. The examples are smaller than Godman and Salvin's figure (Biol. Cent. Am., Rhopalocera pl. 63, fig. 13) and the black border of the secondaries is not so broad, being generally reduced to a series of black points.

Eurema albula Cramer;

Specimens from Margarita are rather more heavily bordered than those from Panama, and the tinge of sulphur at the base of the wings is more pronounced.

This species was abundant in the deep forest in the vicinity of the water courses, but did not occur on the lower slopes of the mountain, nor about El Valle.

Eurema lydia Felder.

One specimen obtained.

Eurema vitellina Felder.

Occurred about El Valle.

NYMPHALIDAE.

Colaenis julia Fabr.

Seen on two occasions near El Valle, but eluded capture.

Agraulis vanillae Linn.

With the exception of *Pontia monuste*, this was the commonest butterfly occuring most abundantly in the cocoanut groves, especially in the more shaded portions. In flight it closely resembles *Colaenis julia*.

Apodemia erostratus Doubl. & Hew.

Specimens from Margarita have the black markings less extensive than in those figured by Doubleday and Hewitson, and by Staudinger.

This butterfly was found on the scrubby hillsides about El Valle. It was often seen in the hottest places, where there was practically no vegetation. It is readily captured, resembling in its habits *Euphydryas phaeton*.

Mestra hypermnestra Hubn.

Very common in the cocoanut groves and about the roadsides near El Valle.

Junonia coenia Hubn.

Common in the cassava plantations, about the borders of the cocoanut groves, and in the hotter portions of the groves themselves.

Eunica monima Cramer.

One battered example secured.

Eubagis agacles Dalm.

Several specimens obtained about El Valle.

Eubagis theseus Felder.

Common in the cocoanut groves about El Valle, occuring with *E. agacles*, but more abundant than that species. The contrasting black and white of its wings make it a rather conspicious object, considering its size.

Amphichlora ferentina Godt. [Plate I. fig. 2.]

Common in the cocoanut groves about El Valle. When flying it occasionally produces the clicking sound so characteristic of the group, and it always alights head down. When alarmed, it seldom goes far, often only to the next tree. Its flight is, as a rule, low, rather swift, and in a straight line, reminding one of the flight of *Argynnis lathonia* or of *Euptoieta claudia*, but is more hurried than that of either of these.

Specimens from Margarita differ from the continental examples which I have examined in being uniformly smaller, with a greater amount of white in the ground color of the wings, particularly of the secondaries.

Amphichlora poseidon, new species. [Plate 1. fig. 1.]

Type locality, El Valle, Island of Margarita, Venezuela.
Expanse, 2.6 in.

General ground color of the secondaries and basal third of primaries, a uniform pale dusty bluish gray, with reflections of reddish bronze.

Primaries. Outside of a crenulate line beginning two-thirds of the distance from the base of the wings to the end of the cell, and extending in a direction almost at right angles to the costal margin to a point one-quarter of an inch from the outer edge of the wing, on the posterior border, chalky white, with a narrow line of gray in the cell near its distal extremity, and a wavy gray line parallel to the outer border of the wing, beginning a quarter of an inch from the distal end of its inferior margin, and extending to the vein passing from the middle of the distal end of the cell to the edge of the wing, then turning and running to the costal margin in a direction at right angles to it. The distal border of the primary is light gray, interrupted in seven places by white streaks, the sixth from the apex being almost as wide as the distance apart of the veins between which it occurs. Just inside this border is a row of five white spots, separated from the general ground color by irregular borders of light bluish gray. The first two of these spots are small, and are situated at the apex of the wing; the third, which is larger, is separated from the second by two veins. The fourth, which is the largest of all, is separated from the third by one vein, and the fifth, which is small, is one vein beyond the fourth. Midway between the two apical spots and the wavy line mentioned above, there is a patch of light gray, which extends as far as the second vein from the costal margin. The part of the wing proximal to the crenulate line before mentioned is bluish gray, with two brownish zigzag lines running parallel to the outer margin of the wing, from the cell to the inferior border. In the cell there is a faintly enclosed median spot, in the middle of which there is a tinge of rufous.

Secondaries. Ground color bluish gray, with a slightly darker border, separated off by a wavy line of brown. Inside of this border are four ocelli, the two anterior being rather smaller than the others, and having white centres bounded proximally by crescents of dark brown. The two posterior ocelli have a median transverse band of black, with a lunate spot of white in the distal, and a corresponding patch of rufous in the proximal half. Inside of the row of ocelli is an irregular line of brown. Inside this line there are a few spots separated off from the ground color by narrow dusky lines, as follows: in the cell, about one quarter of an inch from the proximal end there is a double spot, extending transversely across the cell, and anterior to this a small circular spot. Just distal to this series, is a row of four spots, the most anterior of brown, and close to the small circular spot just mentioned; the next gray, and just the size of the anterior circular spot of the series proximal to this; the third small, and wholly brown, and the last, which closes the cell, long and narrow, with a gray centre.

The under surface resembles that of *A. ferentina*, but the brown markings are narrower, the rufous centre of the spot which occupies the middle of the central cell on the primaries lighter, and the whole surface shows a more pronounced coppery reflection. The tips and under surface of the antennæ are light rufous.

This species is readily distinguished from *A. ferentina* by the great amount of white on the primaries, and its lighter bluish color, bronzy reflections, small size, and finer markings on the lower surface. The two are easily recognizable in life at a considerable distance.

From all others of the genus it is distinguished by the colors as described.

Messrs. Godman and Salvin mention (Biologia Centr. Amer. Rhopalocera p. 269) a peculiar specimen of *Ageronia glauconome* which was taken at Manaure in northern Colombia, in which the cretaceous white of the primaries is more extensive, and more broken up with the gray marks than in the normal form. They state further that "the discrepancies are in the direction of *A. ferentina*, and the specimen may prove to be an extreme form of that insect, or a new species." From this very meagre description, it would seem that the butterfly referred to was *A. poseidon*; but we cannot be entirely sure; however, it is very possible that this species will be found to occur in suitable localities throughout Venezuela and Colombia.

On Margarita, as has been mentioned above, *A. poseidon* is found in the damper spots on the border of the forest, and does not seem to frequent the open so much as does *A. ferentina*, prefering, as a rule, the same kind of situations as those in which *Peridromia amphinome* commonly is found.

Historis odius Fabr.

While on the beach at Carupano I saw what I was positive was an example of this species, coming in over the sea from the direction of Margarita. It passed within a few feet of me, but I was unable to secure it. Captain Robinson tells me he secured an "*Aganisthos*" on the island, which might possibly have been of this species.

AGAPETIDAE.

Euptychia phares Godt.

The commonest of the genus of Margarita, occurring abundantly in the cocoanut groves, especially in the more shaded portions underneath the mango or other thick trees. Godman and Salvin say that this species is nowhere abundant, though having a very extensive range.

Euptychia camerta Carmer (*sosybius* Fabr.)

One specimen obtained, in company with *E. phares*.

Euptychia ocirrhoe Fabr.

Two worn and faded examples obtained near El Valle.

Euptychia renata Cramer.

One specimen secured.

MORPHIDAE.

Morpho sp.

Examples of this genus were sometimes seen in the forest, but never except as one looked down over the tree tops from some elevation.

BRASSOLIDAE.

Opsiphanes sp.

While resting under a mango tree one day, my attention became fixed on a peculiar projection from the otherwise perfectly smooth trunk. Investigation showed it to be a butterfly of this genus, perched head downward. As I had no net at the time it escaped, and I did not find any others.

HELICONIDAE.

Heliconius melpomene Linn.

Abundant on the lower slopes of the mountain, in the vicinity of water, especially at the place where "El Rio" emerges from the forest. It often strays into the cocanut groves, and sometimes into the street of El Valle.

ITHOMIDAE.

Ithomia andromica Hew.

Common in the forest, in the immediate vicinity of streams.

Ithomia hippocrenis Bates.

One specimen obtained in the forest near "El Rio."

Ithomia sp.

Captain Robinson reports finding two additional species of this genus on Margarita.

LYMNADIDAE.

Anosia plexippus Linn.

Common in suitable localities, particularly about the butterfly weed (*Asclepias tuberosa*).

Anosia berenice strigosa Bates.

Common, with *A. plexippus.*

LYCAENIDAE.

Thecla argiva Hew.

One specimen from El Valle.

Thecla sp.

A medium sized species of this genus was taken at El Valle, but was so worn as to make identification impossible.

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DESCRIPTIONS OF SOME MOSQUITO LARVÆ, WITH NOTES ON THEIR HABITS.

BY JOHN B. SMITH AND JOHN A. GROSSBECK.

The larvæ here described are figured with structural details in a forthcoming report of the New Jersey Experiment Station, on the "Mosquito Investigations"; but as that report will appear later than was expected, it is deemed best to give a few notes with descriptions of heretofore undescribed larvæ in advance. The descriptions were drawn up by Mr. Grossbeck from office material; the notes and comments are by the senior author.

Culex squamiger Coq.

Larvæ of this species were first taken in April, 1903, by Mr. Grossbeck near Paterson, N. J., in woodland pools associated with *Culex canadensis*. They were recognized as distinct from any other that we had met with, but were not bred. May 2nd., of the following year Mr. Van Deursen, another assistant, brought in a lot of what were accepted as full grown *C. canadensis* larvæ, collected in the woods near New Brunswick, N. J. Pupation began May 3rd, and adults commenced to issue May 7. May 9, a male *squamiger* was found with the *canadensis*, and an examination of the breeding jar resulted in the discovery of one *squamiger* larva and its identification with the Paterson form. No other adults hatched from the pupæ. Another collection was made May 16, mostly pupæ of *canadensis*, but amongst them were some very large ones. From this lot 3 ♂ and 2 ♀ *squamiger* emerged May 17; 5 ♂ and 4 ♀ May 18, and 2 ♂, the last of the lot, on May 19. Other collections in the same locality were made at intervals throughout the season; but no more larvæ were found. This indicates a single brood; furthermore, adults were taken up to the middle of July, the late ones being so worn as to be almost unrecognizable.

The larva in general appearance resembles *Culex canadensis*; but is much larger, measuring 12-14 mm., in length, exclusive of the anal siphon. It is dirty gray in color, excepting the head and siphon. The head is almost as broad as long, widest immediately below the eyes, tapering without curve to beyond the base of the antenna, flattened in front, light brown in color, and with four small black spots near the base of the vertex. On the anterior part of the vertex are four apparently single hairs, each arising from separate pits; the pits so placed as to form a square, slightly narrower in front; directly opposite the posterior pair, at the base of each antenna, is a small tuft of 4 to 5 hairs. The antenna is rather short, curved, uniformly brown in color, the surface sparsely set with short, stout spines and with numerous small spinules scattered on the basal half. The tuft of 4 or 5 hairs is situated at the middle of the shaft and does not reach the tip of the antenna, which has the apex terminated with one long and one short spine, two short bristles and a short articulated peg. The eyes are of moderate size, semi-circular in outline with a small detached portion at the posterior edge. The rotary mouth brushes are thick, with the hairs in the more central part distinctly pectinated. The mentum is triangular in form, about as long as broad and with slightly curved series of from 12 to 14 small teeth on each side of the apex. The mandible is normal, set with small spines at its base. The maxillary palpus is short and very broad, with hairs and spines arranged in patches on the surface and with a comparatively small apical tuft; the basal joint rather large, with small stout spines at its apex.

The thorax is rounded, with rather short hair tufts issuing from slight angles at the sides. The anterior margin also with two short hair tufts.

The abdomen is long, the anterior two segments transversely oblong and with lateral tufts of 4 or 5 hairs; the central and posterior joints lengthened and narrower, with only two hairs to the lateral tuft up to segment 7. The eighth segment has lateral patches of from 28 to 34 scales, without any regular arrangement; the single scale has spines at the apex and along the sides, the apical one largest and longest, the others diminishing in size toward the base. The anal siphon is about four times as long as its width at the base, and has two series of toothed spines, each ranging from 17 to 22 in number. The spines are black, white tipped, with the teeth not quite reaching the middle; a common arrangement is for four teeth to form two pairs. The ninth segment is longer than wide, with a double dorsal tuft and ventral brush, the latter confined to the barred area. The dorsal chitinized saddle does not ring the segment. The tracheal gills are only a little longer than the ninth segment.

Culex niveitarsis Coq.

This species was first met with May 9th, on the Garret Mts., near Paterson. Only a single fully matured larva was taken; it occurred in a rocky pool with larvæ and pupæ of *Culex canadensis* and *sylvestris*, from which it was at once separated by its conspicuous rusty brown color and robust form. May 12, a new species—*niveitarsis* ♂—hatched from one of the pupæ; and it was recognized as theretofore undescribed, and the larva was put in alcohol. May 14, another collection was made, resulting in five specimens of the new species being found, together with larvæ and pupæ of *canadensis*, *sylvestris* and *Aedes fuscus*. Two of the larvæ were preserved in alcohol and the other three fell prey to some small Dytiscids which had been overlooked in bottom material. From the pupæ one ♀ *C. niveitarsis* emerged May 17. Later collecting in the same pool where they occurred failed to turn out any additional material of this species, and from this it appears that it also is a single brooded, early spring form.

The larva is a very stout, robust wriggler and measures 7–7.5 mm., in length to the end of the ninth segment. In color, it is grayish white, profusely mottled and shaded with brown. The head is about one and one half times as broad as long, and of a yellowish brown color. The posterior part of the vertex is maculated with a dark brown crescent shaped spot and a smaller one each side of it. Six hair tufts of 6 or 8 hairs each arise from the anterior part of the vertex, four in the central part and one at the base of each antenna. The antenna is of moderate length, pale yellowish, becoming brown at the apical third, the surface covered with rather large spines and many smaller ones intermingled; the apex with one long and three shorter spines besides a little joint. The tuft is situated on the shaft considerably below the middle and consists of 8 or 10 hairs. The rotary mouth brushes are deep orange in color, with the hairs of the central part pectinated at their tips. The mentum is triangular in form, twice as broad as high, with nine blunt teeth on each side of the apex. The maxillary palpus is normal, with a large apical tuft, a stout basal joint, and hairs over the surface arranged in rows and patches. The mandible is normal in form, peculiar by its very blunt teeth.

The thorax is rounded with slight lateral angles giving rise to moderate hair tufts; two very small tufts are also on the anterior margin. The dorsal surface is a little depressed and symmetrically blotched with brown. These markings differ as to shape, but always resemble two transverse bands, the anterior one broken in the middle.

The abdominal segments are thick and robust, each with lateral tufts of two hairs each, except the anterior two, which usually have 4 or 5 hairs. The eighth segment has a large patch of small scales on each side, about 45 in each patch, arranged in three or four irregular rows. The individual scale is rather long, broadest in the middle, with a small apical spine, and lateral ones becoming very small basally. The anal siphon is yellowish brown, about three and one half times as long as broad, with the lateral rows of spines extending half the length of the siphon from the base; the single spines broad at the base with one large tooth, or with one or two smaller ones beside the large tooth. The ninth segment is almost square, largely covered by the chitinized saddle; the double dorsal tuft and ventral brush moderate, the latter with two small tufts below the barred area. The anal gills are one and one half times as long as the ninth segment.

Culex siphonalis Grossbeck.

Four specimens of the larvæ were taken in a swampy woodland area, near New Brunswick, N. J., April 25, with *Culex canadensis* and *Corethra cinctipes* They were recognized as new to us by the unusually long and tapering anal siphon, and were put in a separate jar to breed; they did not do well in confinement and May 7, two died, so the other two were put in alcohol. April 27, twenty specimens, all rather well grown were brought in, and on May 2, as many more. They were comparatively rare, and difficult to secure, seldom rising to the surface and inhabiting only the deep pools.

The larva measures 9-11 mm., in length excluding the anal siphon and is not robust in appearance. The body is light gray or yellowish brown in color, with the thorax somewhat darker. The head is about one and one half times as broad as long, yellowish to light brown, though the vertex is often clouded so as to give the appearance of a dark brown head. The posterior part of the vertex is marked by four spots and a semi-circular blotch, which are often obscured by the clouds. Four tufts of two hairs each are situated on the top of the head in the anterior part and a larger tuft is at the base of each antenna. The antenna is moderately long, somewhat sharply curved, the surface sparingly set with spines, rather thickly at the base, and with three or four regular rows of minute spines from the base toward the apex on the inner side. The tuft is well below the middle and consists of but two or three hairs. In color the antenna is brown, very dark toward the tip, the apex with three spines of different lengths, a very short spine and a small joint. The eyes are large and black and the rotary mouth brushes are pectinated in the central hairs. The mentum has slightly curved edges of 11 or 12 teeth on each side of the apical one and becomes very broad at the base. The mandible is normal, with a group of small spines at the base. The maxillary palpus is set with spines and patches of hairs over the surface and has a chunky little joint at its base.

The thorax is as long as broad, only slightly angulated at the sides, the lateral tufts moderately long and, in addition, there are two very small tufts on the anterior margin.

The abdominal segments from 1 to 7 are oblong or sub-quadrate in form, with three or more hairs to the lateral tuft in the first and second segments, two hairs to the tuft in the following segments. The eighth segment has from 24 to 30 scales to each of the lateral patches; the single scales long, with three spines at the apex, the central one very long and very fine ones along the sides.

The anal siphon is pale yellow in color, slightly darker near the tip, very long, being about five times as long as its width at the base and evenly tapered toward the apex. The spines, from 15 to 22 in each row, extend almost to the middle: they vary in size and in the number and length of the teeth; the short ones always toward the base; the apical two separated from the rest and from each other. The siphonal tufts at the end of the rows have but three or four long hairs. The ninth segment is slightly longer than broad with the usual dorsal and ventral tufts, the latter with several small tufts below the barred area. The anal gills are stout and moderate in length without visible tracheæ. The larva differs obviously from that of *cantans* in the antennal structure, in the form and arrangement of the scales on the eighth segment and in the form and armature of the anal siphon.

Culex pretans Grossbeck.

The connection between the larva here described and the adult is not positively made, but there seems little doubt as to the correctness of the association. A mixture of full grown larvæ and pupæ was collected from woodland pools in the Great Piece Meadows, May 10, 1904. The larvæ were put in alcohol and the pupæ left to develop. On May 12, 1 ♂ and 1 ♀ *Culex pretans*, together with specimens of *canadensis* and *sylvestris* emerged from the pupæ. The alcoholic larvæ were examined at once and were found to be *canadensis*, *sylvestris*, *Aedes fuscus* and four larvæ which were new to us, and as we had the larvæ of all other New Jersey species thus far known, excepting *perturbans*, we thought it quite safe to associate them with *pretans*.

The larvæ are from 5.5-6mm. in length to the end of the ninth segment and are pale to dark gray in color. The head is one and one half times as broad as long, yellowish, with a large brown blotch in the anterior part of the vertex, similar to *C. sylvestris*. There are four hair tufts of 4 or 5 hairs each in the center of the vertex and a larger one at the base of each antenna. The antenna is rather short, slightly curved, pale yellow in color, faintly infuscated apically, thickest a short distance from the base and has the surface sparsely set with stout spines and numerous small ones arranged in longitudinal rows. The tuft is situated well below the middle and consists of 8 or 10 hairs which do not reach the apex; the apex with one long spine, several smaller ones and a small joint. The rotary mouth brushes are dense, with the hairs of the central part pectinated. The mentum is triangular in form, with 15 to 17 small teeth on each side of the apex. The mandible and maxillary palpus are normal, the latter with a moderate apical tuft and stout basal joint.

The thorax is very much broader than long, with angulated sides, each angle set with acute infuscated tubercles from which issue moderate sized hair tufts and there are two very small tufts near the anterior margin.

The abdominal segments are subequal, each bearing lateral hair tufts of from 2 to 5 hairs each, the larger number on the anterior segments. The lateral patches of scales on the eighth segment are large, having from 25 to 30 scales in each patch. The individual scale is elongated, with a rather small apical spine and smaller ones fringing the sides. The anal siphon is two and one half times, or slightly over, as long as broad, yellowish brown in color, thickest near the base and tapering a little apically. There are from 16 to 20 spines in each of the rows, the single spine with one or two teeth near the base. The ninth segment is almost square, nearly ringed by the chitinized saddle, and with the double dorsal tuft and ventral brush normal and moderate in size, the latter with several small tufts below the barred area. The tracheal gills are slender, about two and one half times the length of the ninth segment and taper to a point.

Culex inconspicuus Grossbeck.

Larvæ of this species were taken with *C. sylvestris* on the Garret Mts., near Paterson, N. J., Sept. 29, 1903. They began to die off in the breeding jar before it was known that we had a new larva to deal with. Then, only *sylvestris* were left alive but remnants in the bottom of the jar were placed in alcohol. In these remnants only the more strongly chitinized parts of the larvæ remained, the anal siphon and the head case. The antennal attachments seem to offer but little resistance to decomposition: only one had retained them and these were in such condition as not to allow a description to be drawn.

From the pupæ in the jar, adult *C. inconspicuus*, emerged as follows: 1 ♂, Oct. 4; 1 ♂ and 1 ♀, Oct. 5; and 1 ♂, Oct. 6.

The larva presents a general resemblance to *C. sylvestris*, but is much smaller. The mandibles and maxillary palpi are also similar to that species, but the sides of the mentum are more rounded and have fewer teeth,—10 or 12 on each side of the apex. The hairs of the rotary mouth brushes are pectinated. The antennæ as well as could be seen were very much like those of *C. sylvestris*. The anal siphon is about three times as long as broad with 16 to 22 spines in each of the lateral rows; the individual spines are rather slender, and with one or two teeth near the middle, but in one larva the spines were stouter and had as many as four teeth on one spine. The lateral patches are large, each with about 40 to 45 scales, the single scale with long slender apical spines and shorter lateral ones. The ninth segment is as broad as long, not quite ringed by the saddle and with the dorsal tuft and ventral brush moderate in size, the latter with small tufts below the barred area. None of the specimens retained the tracheal gills.

SOME BAHAMA ORTHOPTERA

BY ALBERT P. MORSE, WELLESLEY, MASS.

In the summer of 1904 Dr. Glover M. Allen of the Boston Society of Natural History, and Messrs. Thomas Barbour and Owen Bryant of Harvard University spent several weeks in a zoölogical collecting trip to the northern Bahamas. The orthoptera secured, including some apparently undescribed species, form the subject of the present paper, in which are incorporated several notes by Dr. Allen on the habits of some of the species observed by him. This is the sixth of a series of short papers based on the material collected.

BLATTIDAE.

1. *Ischnoptera blattoides* Sauss. Mangrove Cay, Andros, O. Bryant.
2. *Eurycotis* sp. indet. Mangrove Cay, Andros, O. Bryant.
3. *Periplaneta americana* Linn. New Providence; Mangrove Cay, Andros, O. Bryant.
4. *Periplaneta australasiae* Fabr. New Providence; Mangrove Cay, Andros, O. Bryant.
5. *Rhyparobia maderae* Fabr. Exact locality not given.
6. *Pycnoscelus surinamensis* Linn. New Providence.
7. *Hemiblabera* sp. indet. Mangrove Cay, Andros, O. Bryant.

ACRIDIIDAE.

8. *Orphulella olivacea* Morse. 1 ♂, Stranger Cay, July 14, G. M. Allen. "Fairly common back from the shore along the upper beach."
9. *Amblytropidia?* 1 juv., Nassau, June 28, G. M. Allen.
10. Tryxaline, indet. 1 juv., Nassau, June 28, G. M. Allen.
11. *Schistocerca americana* Drury. 2 ♂ 1 ♀, juv. 3, 5, Nassau, June 28, G. M. Allen; 1 ♂, Elbow Cay, July 3; 1 ♀, Mangrove Cay, Andros, Aug. 1 to 7, O. Bryant; 1 ♂, Stranger Cay, July 14, G. M. Allen.

    "Common at Nassau in the gardens near the hotel. They were also very common at Stranger Cay, where on July 14 and 15 we saw numbers along the edge of the bushes on the upper part of the beach."
12. *Schistocerca* sp. 2, juv. 2, 4, Nassau, June 28, G. M. Allen; pale fulvous in color.
13. *Schistocerca* sp. 1, juv. 3, Nassau, June 28, G. M. Allen; 2, juv. 4, 5, Mangrove Cay, Andros, Aug. 4, O. Bryant; 1 juv. 2, Stranger Cay, July 14, G. M. Allen; color green or yellowish green.

14. **Paroxya dissimilis** sp. nov.

Resembling *P. atlantica* in size and appearance but differing markedly in form of male genitalia. The cerci are nearly three times as long as their basal width, slender, narrowing rapidly in their basal half to less than one-third their basal width, approximately equal in middle third, slightly dilated apically (chiefly on dorsal margin) the ventral margin straight except at base, the dorsal margin sinuous, the apex truncate, slightly more than half as wide as base, its dorsal angle rounded; the whole organ is moderately and regularly incurved, its apex flattened externally, convex internally, with revolute margins. Furcula similar to that of *atlantica* but shorter and the tips less pronounced.

Antenna: (estimated) ♂, 10, ♀, 8; body: ♂, 18.2, ♀, 20.5; hind fem.: ♂, 11.5, ♀, 13.7; tegmina: ♂, 14, ♀, 16 mm.

One ♂, one ♀, Mangrove Cay, Andros, Aug. 4, O. Bryant.

14 a. *Paroxya* sp. juv. 2, 4, 5. Stranger Cay, July 14, G. M. Allen.

Very likely identical with the preceding.

LOCUSTIDAE.

15. *Conocephalus nietoi* Sauss. 1 ♀, juv. 4. Nassau, June 28, G. M. Allen.

16. *Conocephalus* sp. 4 specimens, juv. 1, 2, Nassau, June 28, G. M. Allen; vertex acuminate.

17. *Xiphidium fasciatum* DeG. 1 ♂, 1 ♀, Nassau, June 28, G. M. Allen. In the ♂ the wings barely pass the hind knees, in the ♀ they extend 6mm. beyond them. Mr. Allen states that the green grasshoppers taken at Nassau "were collected among the grass on the estate of Mr. Robert Johnstone. Most of the grass in the Bahamas is confined to such places as have been cleared and cultivated."

18. **Xiphidium insulare** sp. nov.

This is a slender species related to *X. gracillimum* but with the vertex wider (at least one-third the distance between the eyes), and less produced (five-sixths the length of eye viewed from above), the hind femora proportionally shorter, and the lateral lobes of the pronotum distinctly polygonal in outline instead of triangular.

Body: 11; tegmina: 15; wings: 18; hind femora: 10; total length (vertex to end of wings): 22 mm.

1 ♂, Stranger Cay, July 14, G. M. Allen.

Three additional specimens of this genus in early stages were secured, two at Nassau,, and one on Mangrove Cay.

GRYLLIDAE.

19. **Mogisoplistus barbouri** sp. nov.

A larger and stouter species than *slossoni* of Florida, with the auditory foramina elliptic, twice as long as wide (in *slossoni* circular). Pronotum quadrate, narrowed anteriorly, strongly convex transversely, the front and hind margins truncate, the sides barely convex. Hind femora stout, about two-fifths as wide as long. Body and legs clothed with white scales. Hind legs with lower margin of femora, edge of tibiae, and sides of metatarsus with delicate white or brownish pile, the under side of the metatarsus and its spurs covered with a dense brush of brown pile. Anterior and middle legs pilose, and with numerous additional long, slender, scattered hairs, attaining a length on the femur of half its diameter, on the tibia equalling its diameter. Ovipositor rather stout, barely lanceolate at tip.

Body: 10; hind fem.: 2.3x6; hind tib.: 4.5; ovipositor: 5; antenna: 13 +; pronotum: ant. margin, 1.8, post. margin, 2.7, length, 2.4 mm.

One ♀, Nassau, July, T. Barbour.

20. *Cycloptilus americanus* Sauss. 1 ♂, 1 ♀, Nassau, G. M. Allen.

21. *Nemobius* sp. 1 juv. ♂, Nassau, June 28, G. M. Allen.

22. **Nemobius alleni** sp. nov.

Body short, stout, somewhat depressed; antennæ extremely slender, two and a half to three times as long as the body. Beneath brown; above, fuscous, finely maculate with brown. Hind femora with three transverse fuscous fasciae on apical three-fifths, at base brown with numerous narrow, oblique fuscous stripes. Bristles of head, pronotum and legs black; pubescence of body, legs and cerci brown.

Spines of hind tibiae three in number on each side, forming a graduated series with the longest apical spur (which equals the metatarsus) and densely pubescent, the hairs on the ventral side extremely long. Auditory foramina of male linear, of female lanceolate, the apex distal. Tegmina of male covering two-thirds of abdomen, nearly as wide as long, black, indistinctly varied with brown; truncate, the speculum and apical area aborted. Female completely apterous. Ovipositor moderately stout, compressed, gently but distinctly arcuate, shorter than hind femora, the tip slightly lanceolate, minutely denticulate on its dorsal margin; cerci equalling ovipositor, slender, villose, the hairs at base one-third as long as cercus.

Body: ♂, 5 to 6; ♀, 6; hind fem.: ♂, 4.5; ♀, 5; ovipositor: 4; antenna: ♂, ♀, (estimated) 15 mm.

Two ♂, 2 ♀, Moraine Cay, July 13, G. M. Allen. 4 ♂ and 3 ♀ nymphs in the fourth and fifth stages were also secured.

This interesting little cricket, which was collected by Dr. Allen, for whom I take pleasure in naming it, was "found abundantly along the edge of a mangrove swamp that extended for some distance out from the shore. On approaching this swamp from the landward side my attention was attracted by a faint but continuous cricket-like note which seemed to come from all about me. After a careful search among the black roots of the mangroves and the water-soaked leaves at their bases, I found numbers of the little insects. They were extremely quick and agile, and although it was easy enough to see them as they leaped aside at my approach, they immediately became invisible on alighting, so closely did they harmonize in color with the dark sticks and leaves. In this thick undergrowth the use of a net was practically out of the question, even if I could have been quick enough to sweep up the active little creatures. I found, however, that I could easily drive two or three at a time on to a sheet of newspaper that I spread on the sodden surface of the swamp, and with a slow but steady motion a wide-mouthed bottle could be brought above a resting insect and clapped over him before he could escape."

23. **Gryllus bryanti** sp. nov. With the general facies of *G. firmus*.

Head black with faint brownish markings. Pronotum one and a half times as wide as long, black, with narrow, irregular, poorly defined, yellowish-brown markings along the posterior half of the lateral carinæ, anterior half of median line, and anterior and posterior margins. Tegmina black, the veins and venules of the lateral field luteous, entirely covering body, reaching hind knees. Wings fully developed, extending nearly to the end of the hind tibiæ. Legs brownish fuscous, the hind tibiæ with 6 or 7 spines on each side, not widely divaricated; the upper and middle calcaria of equal length, less than one-half the metatarsus (in *firmus* one-half to three-fifths), the longest metatarsal spur reaching less than half way down the last tarsal joint (in *firmus* extending one-half or two-thirds its length.) Ovipositor slender, shorter than body, about one and one quarter times as long as the hind femora.

Body: 22; pronotum: length, 4, width, 6; tegmina: 16; wings: 26; hind fem.: 14; ovipositor: 18 mm.

One ♀, Mangrove Cay, Andros, Aug. 4, O. Bryant.

24. *Cyrtoxipha* sp. indet. One ♀, badly damaged, Nassau, G. M. Allen.

25. *Amphiacustes annulipes* Serv. 1 juv. ♂, Nassau, June 28, G. M. Allen.

26. **Amphiacustes bahamensis** sp. nov.

Related to *annulipes* and *fuscicornis*. Antennæ of great length and extreme tenuity, seven to eight times as long as the body in the male. Vertex strongly depressed at the level of the middle of the eyes. Pronotum once and a half (♀) or twice (♂) as wide as long, its lateral lobes with the ventral margins strongly oblique, the angles broadly rounded. Female apterous. Tegmina of male covering two-thirds to five-sixths of the abdomen, reddish brown, the veins pale yellow; speculum symmetrical, equaling one-third of a circle, arcuate behind, obtuse-angulate (120°) in front, crossed by two dividing venules, the posterior arising midway of the posterior border and curving forward to join it again near the external angle, the anterior arising a little nearer the internal angle than the origin of the first and crossing the speculum by a course at first straight and then for a short distance arcuate to strike the external border at or just behind the external angle. Post-anal vein angulate in the middle, and sending a venule from the angle to the anterior angle of the speculum with whose antero-external border it is continuous save for an almost imperceptible truncation due to the junction of the diagonal vein. Oblique veins 3 or 4, the first two sinuous.

Supra-anal plate of male truncate, its lateral margins sinuate, somewhat revolute, sometimes prolonged at the posterior angles into projecting, vertically placed, flattened processes.

Body dark reddish brown above, pale brown or luteous beneath. Anterior and posterior margins of pronotum and a line behind posterior margin of eyes pale yellow; a transverse poorly defined band on the vertex and another on the anterior third of the pronotum yellowish brown. Legs longer and a little slenderer than in *annulipes*, pale brown and luteous, the hind thighs rusty at base and fuscous along ventral sulcus; the fore and middle thighs not annulate with fuscous as in *annulipes* but all joints sometimes sparsely marked apically with dark brown.

Antennæ: ♂, 115 - 120; body: ♂, ♀, 16.5-17; pronotum: ♂, 3x5.5-6, ♀, 4x6; tegmina: ♂, 6x8.5: ant. fem.: ♂, 10-11, ♀, 10.5; middle fem.: ♂, 11-12, ♀, 11; post. fem.: ♂, 20-23, ♀, 21; post tibiæ: ♂, 21-25, ♀, 23; ovipositor: 16mm.

Three ♂, one ♀, Mangrove Cay, Andros, Aug. 4, O. Bryant. Three ♀ nymphs in the fifth stage and one in the first were also secured.

Dr. Allen writes concerning the crickets of this genus that they "were on several occasions found in numbers just within the entrance of some rather open caves in the limestone rock both at New Providence and on the Abacos. They were crawling about on the roofs of the caves and seemed to avoid the floor. Mr. Barbour caught two or three at Nassau about some large trees towards evening. The note of these crickets is a rasping 'scre-e-e-e-p' with an upward inflection."

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—LVIII.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Mesoleuca vasiliata Guenée.

Egg. Elliptical, rounded, normal, the depression marked; all rounded, no flat areas; evenly reticulate with broad low lines, hexagonal, finely punctate shagreened all over. Pale waxy yellow; size .9 x .6 x .5 mm.

Stage I. Head rounded, whitish testaceous, eye black, mouth brown. Body thin and slender but not rapid in motion, becoming rigid erect when disturbed; white, the ends (joints 2–4, 10–13) yellowish tinged in certain lights from their retraction. No marks; no shields; tubercles concolorous, obscure; setae stiff, pale, rather conspicious.

Stage II. Head rounded bilobed, the apex of clypeus depressed, shining light yellow, ocelli black; width .5 mm. Body slender, rather elongate, normal, coarsely annulate. Setae rather-coarse, white; no shields; tubercles invisible; no marks, food green.

Stage III. Head round, bilobed, free, lobes full, shining ochraceous luteous, clypeus depressed, ocelli black; width .8 mm. Body moderate, green from the food, unmarked, the folded incisures whitish; tubercles a little elevated, round, shining, colorless; feet pale; no shields; setae short, pale; subventral fold prominent.

Stage IV. Head rounded, shining, caramel luteous, setae brown, ocelli black; width 1.1 mm Body cylindrical, slender, the central segments well elongated. Translucent green, incisures narrowly folded, yellowish; tubercles small, round, white, elevated, distinct. The dorsal vessel shows darker and the tracheal line white by transparency. No marks; no shields; thoracic feet brown. About joint 9 a broad stigmatal band begins and runs to the anal feet. It is also slightly indicated on thorax. Setae moderate.

Stage V. Head long, bilobed, green, shagreened, the lobes full, pale greenish, the epistoma, and antennae whitish with a short white band before the eyes; width 1.7mm. Body moderate, elongate, cylindrical, the segments wrinkly annulate, anal feet large, projected outwardly. Green, anal feet and dorsum of joint 13 shaded in vinous; tubercles elevated, rounded, white like small buttons. Very faint longitudial white washed lines; dorsal vessel dark green; setae moderately long, distinct. Later the head acquired a red flush over the lobes.

Food plant thimbleberry (*Rubus nutkanus*); the hatched larvae ate this plant and a wild larva was found on it. Larvae from Kaslo, British Columbia.

RECENT ENTOMOLOGICAL LITERATURE.

MOSQUITOES OR CULICIDAE OF NEW YORK STATE: BY E. P. FELT, STATE ENTOMOLOGIST.

(BULLETIN 79, N. Y. STATE MUSEUM, 1904). The great interest taken in the *Culicidae* by the leading entomologists of the country is most gratifying, and their method of procedure highly commendable, viz: first working out thoroughly the life history of the various species, so as to be able to combat them in the most practicable manner.

It is really surprising the number of new forms which have been discovered since the crusade on the mosquito began. Less than twenty-five years ago the number recorded from North America was 33, and it is only about four years since 24 was the number given for the United States.

This work of about 160 pages and 57 plates, is one of the most important publications on the *Culicidae* that have appeared since Theobald's monograph. An interesting introduction treating of mosquitoes as carriers of disease, their distribution, life history, natural enemies, etc., is followed by description of species supplemented by keys to the genera and species, covering adults and larvae. The work is profusely illustrated by 113 excellent figures in the text, and by 57 plates containing over 200 figures, reproduced from the author's photomicrographs of balsam mounts prepared by D. B. Young. These reproductions are exceedingly fine, especially those of the genitalia, wings, and portions of wings greatly enlarged to show the form of the scales.

The following new species are described: *Culex absobrinus*, *C. magnipennis*, *Corethra karnerensis*, *C. lintneri*, *Sayomyia rotundifolia*, *S. hudsoni* and *Culex abfitchii*, the latter based only on the larvae. The main portion of the work closes with a very complete bibliography of the *Culicidae*, commencing with the year 1847. There is given in an appendix (pages 391a to 391f), "A generic revision of the *Culicidae*," in which are proposed the following new genera: *Culicelsa*, type *taeniorhynchus* Wied.; *Culicada*, type *canadensis* Theo., *Ecculex*, type *sylvestris* Theo.; *Culiseta*, type *absobrinus* Felt; and *Protoculex*, type *serratus* Theo.

C. W. J.

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THE NOVEMBER EXHIBITION.

A public exhibition of insects was held by the Cambridge Entomological Club on November 16, 17, 18 and 19, in the rooms of the Appalachian Mountain Club on the tenth floor of the Tremont Building. The number of visitors, estimated at 350, gave evidence of a growing interest in entomology among the people of Boston and its vicinity. Collections were shown illustrating Variation, Protective Coloration, Hybridity and other phenomena of insect life.

Only a brief mention of each exhibit can be made here. Mr. W. D. Denton entered a fine display of lepidoptera mounted in tablets. Mr. C. V. Blackburn's remarkable collection of moths obtained about two electric lights in the city of Woburn, in a single season, attracted much attention. Miss Soule's hybrid lepidoptera and Mr. F. H. Foster's bred series of Haploas were extremely interesting. Mr. W. F. Low's exhibit was one of the most extensive shown, and embraced, in addition to a fine series of hybrid moths, some remarkable aberrant examples of *cecropia* and *promethea*. Mr. Johnson showed a fine collection of Hymenoptera with Dipterous mimics. Mr. Hayward's exhibit was a carefully-prepared synoptic collection of the families of Coleoptera, with explanatory labels. Mr. A. C. Sampson's display included the five-winged *cecropia* figured in the December Psyche, and a collection of moths showing conspicuous individual variation. Mr. Field entered a number of small groups of lepidoptera arranged to show the phenomena of individual variation, sexual dimorphism, etc. Mr. J. H. Rogers, Jr., had a fine exhibit which included a number of abnormal specimens of lepidoptera. Messrs. W. R. and J. D. Pearmain showed a large number of specimens in tablets. Mr. Newcomb's contribution included a series of very unusual Basilarchias, a series of *Oeneis katahdin* with specimens of *semidea* and *jutta* for comparison, and some interesting aberrant forms of different species. Mr. A. P. Hall showed some of his beautiful photographic prints of bleached wings.

Altogether the affair was a great success, though it is unfortunate that there should be such an overwhelming preponderance of lepidoptera in the exhibits. It is hoped that the present year may be marked by a larger and better exhibiton, which shall fairly represent the activity of New England entomologists.

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EXCHANGES.

[Exchange notices (not over five lines) inserted free for subscribers. Notices will be inserted in the order in which they are received, and those at the top of the column will be removed only when it is necessary to make room for new ones at the bottom.]

AMARA. Being engaged in the study of this genus, I will determine specimens for collectors. These should be sent numbered. I am also anxious to obtain species in other genera of Carabidae not in my collection, from all parts of the world, and will purchase or exchange for same. Roland Hayward, Readville, Mass.

WANTED—Eggs, larvae or pupae of grasshoppers, dragon-flies, beetles, bugs, etc. Will give tropical butterflies in exchange. Denton Bros., Wellesley, Mass.

WANTED—Material for the study of the hybrid or polymorphic butterflies of the genus *Basilarchia*, including larvae or pupae of *arthemis* or *astyanax*, imagos of *proserpina* or *arthechippus* or any specimens showing unusual characters. Liberal exchange. Specimens retained will be deposited in Museum of Comparative Zoology. W. L. W. Field, Milton, Mass.

LEPIDOPTERA—For exchange, fertile eggs of *Hemileuca maia*. Alfred C. Sampson, Sharon, Mass.

I have a few specimens of *C. calleta* and *cinctus* to exchange for rare *Sphingidae* or Pupae of same. W. T. Buxton, 17 Walter St. Somerville, Mass.

WANTED—Ova, larvae or pupae of *Limenitis ursula* and *arthemis*. Will give cash or exchange. H. H. Newcomb, 35 Court St., Boston, Mass.

Will collect Diptera, Hymenoptera, Hemiptera and Coleoptera. Would like in exchange, quantities of named, or unnamed Buprestidae, Scarabaeidae, Cerambycidae and Chrysomelidae. Please write immediately to G. Chagnon. P. O. Box 186, Montreal, Canada.

Correspondence desired regarding Rhopalocera of North and South America, especially Argynnis, Papilio, Morpho, Caligo. Exchange or otherwise. T. H. Shepherd, 15 Hope View, Carr Lane, Shipley, Yorks., England.

EASTERN MASS. MOTHS WANTED in exchange for same. Also, reliable colored sketches of larvæ of same. C. V. Blackburn, 101 Pine St., Woburn, Mass.

Am willing to make contracts to collect for the season, with private collectors, museums colleges, or any public institution for insects of any order or group desired, either in large or small series. Duplicates of all orders for sale from Colorado, New Mexico, and Arizona. Correspondence solicited. Ernest J. Oslar, 4535 Raleigh St. Alcott P. O., Denver, Colorado.

ALPHEUS SPRING PACKARD

PSYCHE

THE ENTOMOLOGICAL WORK OF DR. A. S. PACKARD.

BY JOHN B. SMITH. SC. D.

Very few persons realize the extent or appreciate the character and value of the entomological work done by Dr. A. S. Packard. Not the systematist purely, for he will find much of the work superseded, not accepted, or so generally accepted that the original author is no longer recognized; not the entomotomist purely, for he will recognize only the specific result obtained and not the bearing of that result which Dr. Packard had usually in mind in his anatomical investigations: and surely not the modern economic entomologist, for he has now advanced far beyond any point ever reached by our author.

It is only within the past year or two, when it became necessary for me to study rather closely an almost complete series of his writings, that I began to appreciate the volume and general high standard of Dr. Packard's works. They illustrate a marvelous comprehension of the subject as a whole, a grasp of detail in many groups that is astonishing, and a knowledge of the literature that is surprising when its scattered condition and the variety of languages in which it appeared, is considered.

Dr. Packard was both an investigator and a teacher: as a teacher in the class room or in the laboratory I know nothing of him; as a teacher through books he has taught more students than any other American Entomologist. He was not a writer of numerous short papers, of hasty criticisms or of single descriptions; and yet his publications were many, some of them brief and many critical; but all had a purpose — the conveyance of knowledge or the correction of error — the correction always made without reflecting upon the honesty or capacity of him who made it necessary. Not that Dr. Packard made no errors himself: no one was more ready than he to recognize his liability in that direction, and he was not ashamed to admit it. Not infrequently he changed his conclusions, and when we compare the first edition of the Guide, with the "Text Book," the full extent of the revision of such conclusions becomes apparent.

As a systematist Dr. Packard was interested primarily in the general arrangement of the Class, and he was among the first if not the first American that accepted the necessity of breaking up some of the Linnaean orders and proposed a system of his own as a substitute. Some of his suggestions met with approval, others did not; but in all instances there was at least a plausible case and some actual characters to maintain it. The discussion was always informing, if not always convincing.

In almost every order Dr. Packard did some systematic work or discussed some point in classification: in the Lepidoptera he produced the only comprehensive illustrated revision of any family of considerable extent that has yet appeared in the United States. The Monograph of the Geometridae is as complete as it was possible to make it at the time. Material was secured from all available sources, all the literature was collated and each species was as completely made known as the conditions permitted. But it was not only a species mill: the structure of the insects was elucidated, their relationships were discussed and numerous figures illustrate the discussion. As a piece of systematic work the monograph has its faults; we see them now because of added knowledge and material:—the classification has been largely superseded; but that is the fate of all classifications: there were errors of synonymy of association and of many other divers characters; they have been corrected and the work still stands, useful as ever as a record of facts and as an illustration of the stage of knowledge at the time it was written.

Dr. Packard studied the philosophy of individual insect development from the very beginning as a necessary preliminary to the discussion of the development of the class; hence we find that he was as much at home in ontogeny as in phylogeny, and nowhere is that better illustrated than in the Text Book of Entomology, published by the MacMillan Company in 1898. There is scarcely a topic in that Book to which there is not some original contribution or some reference which indicates that there was actual knowledge and not mere quotation. And this brings up again the wide familiarity with the literature on insect structures and development; most of it printed in foreign countries or Journals, and such of it as is American, scattered in Proceedings, Transactions and Journals of the most diverse kinds. In bringing together and systematizing this mass of material Dr. Packard has rendered a service to Entomological Science which Entomologists have hardly, as yet appreciated. Some of his conclusions are disputed and may be erroneous; but the facts are given and if the expressed convictions are formed on insufficient evidence, time will enable us to make the corrections.

In the line of economic work Dr. Packard was for a time associated with Drs. C. V. Riley and Cyrus Thomas on the Entomological Commission. He contributed to nearly all the reports; but less to the strictly economic subject than to a discussion of principles and to some work on structural characters which may or may not have been entirely pertinent. Yet his connection with the economic side of the study extends back to 1871, the date of his first report on the injurious and beneficial insects of Massachusetts; and even before that he had written on the subject.

The most important contribution in this branch is the Volume on Forest Insects, published as one of the Reports of the Entomological Commission. This exhibits very strongly the painstaking method of gathering all recorded facts and of securing information from all possible sources. As a record of what is known or has been written concerning insects feeding on forest trees in the United States it is a most useful work. The weak point is the absence of a general scheme of remedial measures or forest management which may be applied with necessary modifications in special instances, to lessen or prevent injury.

Dr. Packard, while not without considerable experience in field work, was not a good field collector and observer of habits, and certainly not a good museum preparator. He was essentially a student of specimens, living and dead and of the phenomena exhibited by them.

I will make no attempt to give even a partial list of his more important works: it will suffice to say that the student who is entirely familiar with what Dr. Packard has written is, by virtue of that knowledge alone, a good entomologist.

PROFESSOR PACKARD'S "LAMARCK, HIS LIFE AND WORK."

BY ROBERT T. JACKSON.

The late Professor Packard laid naturalists under deep obligations by his full and painstaking Life of Lamarck, the only adequate account of the great French naturalist. Professor Packard gives all that he could gather by careful search in regard to his family and early life, his struggles with poverty, his activities in numerous lines of scientific work, and a careful consideration of what he accomplished in these several lines. The relations of Lamarck to his contemporaries in his work and thought is forcibly brought out and numerous extracts from Lamarck's writings show what his views were on physical and biological problems, especially evolution. The book is full of evidences of a loving care and reverence for the great master and effort to do full credit to him for his advanced views and what he accomplished.

In respect for Professor Packard's memory it is of interest to record here some of the leading features he brought out in his life of Lamarck, which from the human and scientific aspects should be of exceptional interest to all biologists.

The Life of Lamarck is the old old story of a man of genius who lived far in advance of his age, and died comparatively unappreciated and neglected. The factors of evolution as stated by Lamarck, it is now claimed by many really comprise the primary or foundation principles, or initiative causes, of the origin of life-forms.

Lamarck was born 1 August 1744, and died in Paris 28 December 1829, at the age of eighty-five years. The youngest of eleven children, throughout his life he struggled with poverty and during the last of his life for some ten years was partially, then wholly blind, although married four times he died a widower. A devoted daughter soothed his last years and acting as amanuensis gave to the world some of his important publications.

As a youth Lamarck entered the army which, owing to an injury, he early abandoned. Music, medicine and science drew his attention and he worked in a bank. When twenty-five years of age he devoted himself to botany and science thereafter claimed his entire life. For about twenty-five years he pursued botany and in 1778 published the *Flore Francaise*, a three volume work, he also published other botanical works and was connected with the Jardin des Plantes as Keeper of the herbarium.

In 1793 Lamarck, then in his fiftieth year, assumed the duties of his professorship of the zoölogy of invertebrate animals, and with the vigor of an intellectual giant took up new labors in an untrodden field both in pure science and philosophic thought. Already extensive collections had accumulated at the Paris museum and to Lamarck fell the task of arranging and classifying them as well as teaching. The result of his studies in this line was his great work in seven volumes known under the title *Animaux sans Vertèbres*, the first volume appearing in 1801, and the last, or seventh, in 1822.

Besides botany and zoölogy Lamarck studied and published on the sciences of meteorology, physics, chemistry, geology and palæontology. When a medical student in Paris he studied the clouds from his attic window and (as Professor Ward informs me) published the first classification of clouds. He was the first one to foretell the probabilities of the weather, thus anticipating by half a century the modern idea of making the science of meteorology of practical use to mankind. From 1799 to 1810 he regularly published an annual meteorological report containing the statement of probabilities acquired by a long series of observations.

In palæontology he did pioneer work, he combats the view that fossils are extinct species and that the earth has passed through a general catastrophe, but urges that species have changed as a result of time, and that fossil forms are the ancestors of animals now living. In the first published expression of his views on palæontology in 1801 we find the following truths enumerated on which the science is based: (1) The great length of geological time: (2) The continuous existence of animal life all through the different geological periods without sudden extinctions and as sudden recreations of new assemblages: (3) The physical environment remaining practically the same throughout in general, but with (4) continual, gradual but not catastrophic changes in the relative distribution of land and sea and other modifications in the physical geography, changes which (5) caused corresponding changes in the habitat and (6) consequently in the habits of the living beings; so that there has been all through geological history a slow modification of life-forms. Professor Packard therefore enters the claim that Lamark was one of the chief founders of palæontology and the first French author of a detailed palæontological work. It must be admitted that the statement generally made that Cuvier was the founder of this science must be modified though he may be regarded as the chief founder of vertebrate as Lamarck was of invertebrate palæontology.

Lamarck was a uniformitarian in his views of geology and biology in contradistinction to Cuvier who was a catastrophist. Lamarck contended that species were descended from others, Cuvier that they were permanent.

Lamarck was the master mind of the period of systematic zoology. His tabular view of the classes of the animal kingdom was to his mind a genealogical tree. His idea of the animal kingdom anticipated and was akin to that of our day. He may be said to have had a wonderfully good eye for genera. He founded the classes of Crustacea, Arachnida, Radiata (echinoderms as separate from polyps), placed the sponges (as did Cuvier) with the polyps and separated the ascidians from the mollusks.

Lamarck long believed that species were constant in nature. Evidence goes to show that he changed his views at or soon after 1793, when he entered on his zoölogical work. His first published statements on evolution were in 1801 in the preface of his *Système des Animaux sans Vertèbres*, he being then about fifty-seven years of age. He there maintains that Nature began with the most simply organized "then with the aid of much time and of favorable circumstances she formed all the others." Again "I could prove that it is not the form either of the body or of its parts which gives rise to habits, to the mode of life of animals, but, on the contrary, it is the habits, the mode of life, and all the influential circumstances which have, with time, made up the form of the body and of the parts of the animals. With the new forms new faculties have been acquired, and gradually nature has reached the state in which we actually see her."

One who has read the writings of the great naturalist, who may well be regarded as the founder of evolution, will readily realize that Lamark's mind was essentially philosophic, comprehensive and synthetic. He looked upon every problem in a large way.

"In Lamarck, at the opening of the past century, we behold the spectacle of a man devoting over fifty years of his life to scientific research in biology, and insisting on the doctrine of spontaneous generation; of the immense length of geological time, so opposed to the views held by the Church; the evolution of plants and animals from a single germ, and even the origin of man from the apes, yet as earnestly claiming that nature has its Author who in the beginning established the order of things, giving the initial impulse to the laws of the universe."

In the last chapter of his book Professor Packard deals with the revival of Lamarckian views in the school of Neolamarckians, dating from about 1866 and especially active in this country. Prominent in this school were Herbert Spencer, Hyatt, Cope and Packard. Hyatt and Packard, students of Agassiz's, and life long friends, both of distinctly philosophical minds did much by their researches to further the adoption of Lamarckian views with which they were in warm sympathy.

NOTE.—Mrs. Packard has a number of reprints of Dr. Packard's recent paper on "The Origin of the Markings of Organisms, etc.," (see Index to Periodical Literature) for the distribution of which he left no mailing list. Those who desire copies of the paper are invited to notify her, at 275 Angell St., Providence, R. I.

THE NOMADINE AND EPEOLINE BEES OF SOUTHERN MAINE.

BY J. H. LOVELL AND T. D. A. COCKERELL.

In southern Maine (Waldoboro, Lincoln County) the Nomadine and Epeoline bees are represented by only two genera *Nomada* and *Triepeolus*. The species are few and individual specimens are taken at rare intervals. The species of *Nomada* begin flying as early as April 24th, visiting the aments of *Salix discolor*, which with the exception of the Mayflower is the first nectariferous plant blooming in this locality; and continue on the wing as late as July 30th, when they have been taken on the infloresence of *Aralia hispida*. All of the specimens of *Triepeolus* have been collected in August on the flowers of the *Compositae*.

Nomada.

The species of *Nomada* run into local races and species in different parts of the country, and the Maine species possess certain peculiarities of their own. Two are distinct enough to be treated as new species, though it is not impossible that the discovery of intermediates in localities still unexplored for bees may eventually cause them to be reduced to subspecific rank. Two others, here called varieties, may prove more separable than is here supposed, when larger series have been obtained.

Nomada (*Gnathias*) *bella* Cr.

1863 *Nomada bella* Cr. ♀ ♂ Proc. Ent. Soc. Phil. 2 : 287.

1863 *Nomada maculata* Cr. ♀ ♂, Proc. Ent. Soc. Phila. 2:303 (in part).

1902 *Nomada bella* Rob. ♀ ♂, Ent. News, 13 : 80, no. 3.

1903 *Nomada bella* Ckll. ♀ ♂, Proc. Ac. Nat. Sci. p. 601.

Variety a of *N. maculata* ♀ was based on five specimens from Maine, Conn., Penn., and Delaware. The local specimens correspond in every particular to the description except that the spots on the fifth segment are obsolete as well as those on the fourth. The characters of the males are also similar to those given by Cresson. Length 10 to 11 mm.; mandibles bidentate; the largest species in this locality. Taken from April 24th to July 11th. Early in the season they are visitors to the willows *Salix discolor* and *S. Bebbiana*. Male and female specimens of *N. bella* from Elkhart, Indiana, are the same as the local species except that the cream-colored spots on the apical segments are usually well developed.

Nomada (*Gnathias*) *cuniata* Rob. var. e.

1903 *Gnathias cuneatus* Rob. ♀ ♂, Can. Ent. 35: 175, no. 6.

♀. — Length 8mm.; mandibles bidentate; resembles *N. bella* but is smaller, with thorax trilineate. Head and thorax red, not coarsely punctured; white pubescence on cheeks and pleura long; a black dot on each side of clypeus, the area about the insertion of antennæ and ocelli black, a red spot on supraclypeus; occiput black; antennae ferruginous, fourth joint longer than third. Mesothorax trilineate, the middle band broad; scutellum and post-scutellum red, sutures black; pleura black above with a red spot, red below; metathorax with broad black bands at the sides and in the center; tegulae and tubercles ferruginous. Legs red; upper third of anterior and middle femora black beneath; posterior femora blackened behind. Wings dusky, apical margin darker; pale-lunule distinct; basal nervure basad transverse medial nervure more than the length of the latter; third transverse cubital nervure strongly angulated in the middle. Abdomen red, broad, strongly convex; black area on basal segment lobed in the center; a pair of small cream colored spots on the sides of second segment; apical segments without markings.

Waldoboro, Maine, May 18.

Nomada (Xanthidium) subrutila n. sp.

♂.— Basal nervure meeting transverse medial; flagellum obscurely denticulate, lively ferruginous beneath; supraclypeal mark well developed, surrounded by black; orbits yellow except at summit behind; third antennal joint on the short side much shorter than fourth; scutellum black with two small yellow spots; metathorax entirely black; tegulae light yellow, with a hyaline center and margin; band on first abdominal segment broadly interrupted, the posterior part of the interval reddish; bands on second and third segments not at all interrupted; anterior and middle tibiae yellow, with a black or dark brown mark behind. Other characters as in *N. luteola* and *N. luteoloides*; size that of a rather small *luteola*.

One male taken on *Viola rotundifolia* May 4th. The species recognized in this group are very closely allied, but the present one seems as distinct as any.

Nomada Cressonii Rob.

1863 *Nomada maculata* Cr. ♀, var. b, Proc. Ent. Soc. Phil. 2:304.

1893 *Nomada Cressonii* Rob. ♀ ♂ Trans.Am. Ent. Soc. 20:275.

This species has been taken on *Viburnum Alnifolium* and *Cornus Canadensis* from May 19th to July 11th.

Nomada florilega n. sp.

♀.—Length about 8 mm.; black and red, rather robust. Face, cheeks and pleura clothed with white pubescence, sides of metathorax fringed with long white hair. Mandibles except apices which are darkened, labrum, clypeus, usually a narrow line along the orbits, and vertex red; face, region of ocelli, cheeks and occiput black; flagellum ferruginous in front, blackened behind, third joint shorter than fourth. Tegulae and tubercles ferruginous; mesothorax dark red tinged with black, with a rather broad median longitudinal line; sutures black; metathorax entirely black, pleura black above with a middle red spot, red below. Legs red, coxae largely black; upper half of anterior and middle femora black beneath; posterior femora blackened behind except at extreme apex; first and second joints of hind tarsi blackened without. Wings dusky, strongly darkened on apical margins; stigma ferruginous, outer half darker than the inner; basal nervure basad transverse medial; second submarginal cell about one half as wide on the radius as on the cubitus; second and third transverse cubital nervures strongly curved; lunule rather prominent. Abdomen oval or oblong oval, convex; basal half of first segment black, posterior margin of black area cordate; a pair of small cream-colored spots on the sides of segment two; on segment three two minute dots; apical segments without ornaments.

Taken on *Aralia hispida* and *Spiraea salicifolia* during the latter half of July. Nearest *N. sayi*, but larger and darker, the metathorax being entirely black, and the red of the coarsely sculptured mesothorax very dark.

Nomada nigrocincta Smith, var. d.

1879 *Nomada nigrocincta* Sm. ♀ Des. New Sp. Hym. p.99.

♀.—Length 8mm.; ferruginous and black. Head and thorax rather finely punctured; pubescence on cheeks, pleura and sides of metathorax white, on face and disc of mesothorax fuscous. Mandibles except tips, labrum, clypeus, spot on supra-clypeus, a narrow stripe around the eye, and antennæ ferruginous; area about insertion of antennæ, about ocelli and occiput black. Prothorax black; mesothorax trilineate, the middle band rather broad; scutellum largely red, postscutellum black; metathorax entirely black; pleura black, red spot beneath the wings, another anteriorly on each side of the forelegs; tegulae and tubercles ferruginous. Legs ferruginous, marked with black much as in the preceding species, Wings nearly hyaline, slightly dusky at apex; basal nervure very little basad of transverse medial, much less than in the preceding species; second submarginal cell along the radius nearly as long as second transverse cubital nervure; third submarginal along the radius fully one half as long as second submarginal

Abdomen oblong-ovate, ferruginous, without maculae, the apical margins fuscous or blackened; posterior margin of black area on basal half of first segment straight; pygidial plate broad and rounded.

Collected May 18th. Distinguished by its color from any other of the local species. This may represent a distinct race, but the single specimen obtained has the essential characters of Smith's species, and is really more typical of it than the insect from Corvallis, Oregon, which has been referred here.

Triepolus.

Triepolus donatus Smith.

1854 *Epeolus donatus* Sm. ♀ ♂, Cat. Hym. Brit. Mus. 2:256.
1864 *Epeolus donatus* Cr. ♀ ♂, Proc. Ent. Soc. Phil. 2:396.
1882 *Epeolus donatus* Prov. ♀, Nat. Can. 13:236.
1883 *Epeolus donatus* Prov. ♀, Faun. ent. Can. Hym. p. 719.

Though rather rare this species is more common in this locality than any other of this genus or of *Nomada*. Both sexes have been taken from August 11th to August 24th on the goldenrods, thistles, *Inula Helenium* and *Eupatorium perfoleatum*.

Triepeolus scutellaris Say.

1824 *Epeolus scutellaris* Say, ♀, Long's 2nd Exp. 2:355.
1859 *Epeolus scutellaris* Say, ♀, Lec. ed, Say's Writ. 2:240.
1864 *Epeolus scutellaris* Cr. ♀, Proc. Ent. Soc. Phil. 2:397.
1888 *Epeolus scutellaris* Prov. ♀, Add. faun. Can. Hym. p. 332.
1897 *Epeolus scutellaris* Rob. ♀ ♂, Trans. Ac. Sci. St. Louis, 7:343.

Two males taken on *Solidago* in August are referred to this species, which has been reported from Florida to Canada. They agree with the description in size and in the form of the dilated thoracic teeth, but not entirely in color. The mandibles, tubercles, tegulae, lateral teeth, scutellum in one specimen, and legs are ferruginous; but tbe antennae and basal segments of the abdomen are black.

Triepeolus pectoralis Rob.

1897 *Epeolus pectoralis* Rob. ♀ Trans. Ac. Sci. St. Louis, 7:345.

Both sexes taken on the flowers of *Solidago* August 17th. The female has the mesothorax closely and finely punctured, and the pleura below coarsely and sparsely punctured. The male is undescribed.

♂. — Length about 8mm., closely resembles the female. The face clothed with silvery white, the pleura and pectus with cinereous pubescence. Ornaments of thorax and abdomen buff-colored, fascia of sixth segment white.

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE—LIX.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Euchlaena astylusaria Walker.

Egg. Elliptical, well flattened, one end depressed, truncation rounded, not very obvious. Surface dimly hexagonally reticulate, the cell areas rather deep and pronounced but not sharp and all overlaid and obscured by fine granules of shagreen. Towards the large end the pores at the angles of the reticulations are marked by large, distinct, rounded white elevations, but these become small towards the center of the egg and are lacking on the small end and the flat sides. Truncation reticular without white elevations. Bluish green, frosted by the white dots, turning bright red. Size 1 x .6 x .5 mm.

Stage I. Head brownish luteous, the sutures dark. Body moderate, subdorsal and ventral broad red brown stripes, the subdorsal pair fused on joints 10-13 and marked in pale on the cervical shield. Sides white; abdominal feet stained with red, thoracic ones luteous.

Stage II. Head rounded bilobed, whitish, clypeus and epistoma white, all the sutures dark brown; two parallel rows of gray dottings over the lobes; width .55 mm. Body slender, greenish white; broad subdorsal bands joining posteriorly, dotted on joint 2, and broad ventral band purple brown. Thoracic feet brownish black, the abdominal ones reddish. Tubercules pale, setae black, both minute.

Stage III. Head oblique, flat before, lobes full; whitish with vertical rows of brown dots; and band across the bases of the antennæ; width 1 mm. Body moderate, slightly flattened, tubercles raised; dorsum brown, darker posteriorly on the segments, a geminate dotted dorsal line pale filled; sub-ventral fold white, subventer brown, venter dark purplish brown with fine geminate medioventral pale line. Small segmentary black subventral spots under the white fold. Feet pale; tubercles small, black; setae minute.

Stage IV. Head widest below, slightly bilobed, clypeus depressed; gray, spotted with black heaviest on the lower angles of the lobes and across above the mouth; a pale streak on the side, width 1.5 mm. Body moderate, slaty gray, slightly streaked. Tubercles ii of joints 5, 8, 9 and 12 elevated, papillose, black, with black subdorsal blotches beside them, present but less distinct on the other segments. A broken, diffuse white band along the sub-ventral fold. Abdominal feet whitish outwardly, lined with black in front. Subdorsal, lateral and suprastigmatal pale lines indicated.

Stage V. Head round, somewhat quadrately bilobed; whitish gray mottled with darker, a black patch each side of the clypeus below and across above the mouth and on bases of antennæ, width 2.3 mm. Body moderate, tubercle ii raised and marked in black, especially on joints 5 and 11. Ashen gray with traces of waved white lines; dorsum of joints 5, 6, 7 and 8 washed in whitish, sides with irregular black marks, whitish intersegmental washings on the subventral fold; foot of joint 10 whitish, the others gray. Feet of joint 4 erected, the others appressed. The resemblance is to bark, all the markings being illy defined.

Eggs June 14, mature larva August 6, single brooded with hibernation in the pupa. Larvæ from Kaslo, British Columbia.

NOTES ON SHORT EXPERIMENTS BEARING ON THE RELATION OF LARVAL TO ADULT LEGS.

BY ALEC. ARSENE GIRAULT, WASHINGTON, D.C.

"The real relations of the adult legs to the larval legs are thus shown by Gonin.

'If we carefully strip off the skin of a caterpillar near the time of pupation (Fig. 608), we see that the extremity only of the legs of the imago is drawn out of the larval legs; the other parts are pressed against each side of the thorax: near the ventral line a small pad represents the coxa and the trochanter; the femur and the tibia are distinctly recognizable, but soldered to each other and only separated by a slight furrow; they form by their union a very acute knee or bend. The femur is movable on the pad-like coxa, the tibia continues without precise limits with the extremity concealed in the larval legs. The three divisions of the latter do not appear to have any relation to the five joints of the perfect state. Under the microscope the rudiment appears very strongly plaited at the level of the tarsus, much less so in the other regions. A large trachea penetrates into the femur with some capillaries; reaching the knee it bends into the tibia at a sharp curve, but does not become truly sinuous in approaching the extremity. It is then the tarsus especially which is susceptible of elongation; it may, on being withdrawn, give rise to the illusion that the whole organ is disengaged from the larval leg.

Even when we cut off the limb of the caterpillar at its base, we only remove the tarsus of the imago; the femur and the tibia remain intact. From an evident homology Réaumur has erroneously concluded that there is an identity. His opinion, classical up to this day, that the limb of the butterfly is entirely contained in the leg of the caterpillar, has been found to be inexact and should be abandoned.' "[a]

From the foregoing quotation, the following short experiments performed on the larvæ of *Heliothis obsoleta* Fabricius,[b] are easily understood.

On the 20th of June at Paris, Texas, ten (10) full-grown larvæ of this insect were taken from ears of corn and placed on fresh soil in the laboratory. They were ready to enter the soil. The anterior legs of each were immediately cut off with sharp scissors, taking care, during the operation, to remove the articulated joints only. The larvæ were then allowed to enter the earth, which six of them successfully accomplished during the following night. The remaining four were found dead and were removed.

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[a] Packard. A Text-book of Entomology 1898 pp 654-655.

[b] Formerly *Heliothis armiger* Hübner.

From these six larvæ, three moths appeared on July 7th, following. Of the three, two had perfect legs. But the other had *two of the apical joints of its dextral foreleg missing, the third and last joint bearing the usual tarsal claws.* The conclusion to be drawn is obviously indicated by reference to the lines quoted.

Other experiments performed were failures because of the corresponding moths not issuing. The pupa of a larva whose legs had been amputated at the origin of the articulated joints, was dissected when some days old, and the half formed moth found with perfectly formed limbs.

Two full-grown larvæ were transferred to soil in a large glass jar and treated as formerly, but in addition to the articulated joints, a portion of the large lobe of the body to which the legs are appended was also removed, doubtless injuring the so called histoblast. When cut, both of them jumped violently and a stream of dark liquid was ejected from the mouth. They immediately crawled off, however, when liberated seemingly not missing the pair of legs. The wounds bled for a short while, but healed the next day, then showing as large blackened scars. Although feeding voraciously, and apparently ready to pupate, both suddenly declined and died, and for lack of time the experiment was not repeated.

The percentage of moths successfully emerging from larvæ thus mutilated is very small, and it is very necessary to use larger lots in experiments such as these.

RECENT ENTOMOLOGICAL LITERATURE.

EARLY STAGES OF CARABIDAE.

Among the recent publications on Entomology is one which is of especial interest to Coleopterists, by Dr. George Dimmock and Mr. Frederick Knab, entitled: "Early Stages of Carabidae," (Springfield Museum of Natural History, Bulletin No. 1, 1904, pp. 1–55, pls. 1–4). It is certainly a valuable contribution to our knowledge of the larvæ and metamorphoses of the family of which it treats, and is of interest to systematists as well as to students of life history, for, as is every day becoming more apparent, when our knowledge of the early stages of Coleoptera is sufficiently developed, we shall doubtless find that the larval characters will be of much service in determining the correct position of many groups the relationship of which is now more or less obscure.

The article is written by Dr. Dimmock from notes taken by both authors. Plates 1–3 are drawn by Mr. Knab, the fourth plate by Dr. Dimmock.

After a few prefatory remarks, the reader is informed of the method employed by the authors in rearing larvæ, and directions are given for so doing, as well as for the proper study of them. Great stress is laid upon the importance of the study of larval exuviæ, which often "reveal many structures not visible on the larva itself," and instructions are given for mounting on microscope slides in order to preserve them for examination. This is followed by a thorough resume of our present knowledge of the characters of Carabid larvæ, evidently the result of long and careful reading and study. Each character is fully discussed, examples are cited, and references given to an ample bibliography, which closes the paper.

A large part of the paper is devoted to descriptions of the metamorphoses of *Dicaelus purpuratus*, *Brachynus janthinipennis*, *Pterostichus stygicus and P. adoxus*, those of the last two species having not been described heretofore. Very full and detailed descriptions are given of the larvæ, larval habits, pupa, emergence and changes in color, both before and after emergence. In the descriptions of the larvæ, a system of formulæ is employed, which seems to be a very useful method for the comparison of the jointed appendages of different species, as well as of the proportionate length of the joints themselves. This is best explained in Dr. Dimmock's own language. With regard to the antennæ, he says: "The proportionate length of the joints of the antennæ differs according to genera and species. It is conveniently shown in descriptions by means of antennal formulae. They are made up of the successive lengths (relative or absolute) of the joints,—the proximal first, the distal last — with the length of the appendix enclosed in parentheses." The following will serve as an example, the length being given in millimeters:

"Antennal formula in larval exuviae at pupation:

0.38 1.62 1.85 (0.03) 2.15"

The resumé of characters above referred to is so thorough and of such general interest we give it in full, only regretting that lack of space prevents us from adding the copious notes and references which follow the description of each member. Carabid larvæ are thus defined:

"Hexapod larvae with the ventral side of the body straight, i. e., fitted for locomotion on horizontal surfaces; and with nine abdominal segments, the last exserted and bearing an anal tube and almost always a pair of cerci.

"Stigmata rounded, open; one thoracic and eight abdominal pairs; those of the thorax large, at each side of the mesothorax, beneath the anterior angle of the dorsal scute; those of the abdomen smaller, lateral, on each of the first eight abdominal segments. Gills never present.

"Head corneous, porrect, with the very small suctorial mouth usually directed anteriorly and the cervical foramen posteriorly.

"Frontal angles more or less ascending in an oblique direction above the mandibles; in most cases defined by a deep furrow; acute, obtuse or rounded at their apex.

"Epistoma usually included in the vertex.

"Clypeus concrete with the epistoma; labrum wanting.

"Hypostoma usually short and included in the occiput.

"Ocelli usually six on each side, generally on a defined ocellar area, which is often protuberant.

"Antennae filiform (exceptionally conical), four-jointed, the slender apical joint tipped with sensory setae. The distal end of the third joint bears an appendicular joint, or appendix, which is sometimes very minute.

"Mouth-parts exserted, free.

"Mandibles falciform, acute, directed forward and somewhat upward, not suctorial, and with a tooth, or retinaculum, on their inner side, at or posterior to their middle.

"Maxillae inserted between the mandibles, near the labium; cardo extremely short, fixed; stipes flattened cylindrical, directed anteriorly. The slender two-jointed exterior lobe (galea) of the maxillae is inserted on the maxillary stipes, and is motile. Interior lobe (lacinia) rudimentary or wanting. Genae without maxillary scrobes. Maxillary palpi filiform, three-jointed, sparsely furnished with setae, and borne on a short conical palpigerous stipes (squama).

"The mentum is small, usually transverse, trapezoidal. The stipites of the labial palpi are concrete; taken unitedly, quadrate-clavate. Labial palpi two jointed, often sparsely setose. The ligula generally bears two setae.

"Thorax of three segments, of which the prothorax is longest; each segment, except in rare cases, provided with dorsal scutes.

"Dorsal scutes of thorax concrete at median line, those of the prothorax entire and concealing the sides.

"Praeterga of thorax usually evident, often strigose; praetergum of prothorax the longest.

"Postterga of thorax usually evident, often strigose.

"Sternal scutes of prothorax evident, usually concrete at median line; those of the mesothorax and metathorax minute or wanting.

"Legs six-jointed; consisting of coxa, trochanter, femur, tibia, tarsus, claw (usually double); of moderate length, showing in dorsal view of the larva, when they are extended, at least part of the tibiae and the tarsi and claws.

"Coxae conical, exserted, in length less than four times the thickness of their base; with a (sometimes short inconspicuous) femoral scrobe; increasing in length from fore to hind pair.

"Trochanters clavate, usually shorter than the coxae, and bearing ambulatorial setae.

"Femora clavate, setose, and usually shorter than the coxae.

"Tibiae more or less clavate, more than one-third as long as the femora.

"Tarsi exserted, movable, usually conical-cylindrical; equaling the coxae in length, or shorter; usually longer than the tibiae.

"Claws usually two on each foot. Empodia generally of two very short setae.

"Abdomen straight, more or less depressed, cursorial or ambulatorial, longer than the thorax, and with the dorsum unarmed. Ninth abdominal segment exserted.

"Dorsal scutes, when present, on the abdomen, concrete at median line, and with praeterga and postterga.

"Dorsal scute of the ninth abdominal segment usually present.

"Lateral scutes of the abdomen often defective; when present, exserted, oblong, convex.

"Ventral scutes of the abdomen often defective. When developed, seven on each segment. viz: a large transverse median scute anteriorly; behind this a transverse row of four small scutes, of which the median pair may be concrete; at each side of these five scutes an elongate longitudinal scute. On the eighth and ninth abdominal segments the five median scutes are more or less concrete.

"Anal tube exserted; conical, conical-cylindrical or cylindrical; usually somewhat longer than the ninth abdominal segment, and generally used in locomotion. Anus terminal.

"Cerci, with rarest exceptions, present, and attached to the dorsum of the ninth abdominal segment.

"Habits active, commonly predaceous; usually subterranean, or living under stones or pieces or wood, or beneath loose bark on decaying trees; usually nocturnal, or shunning light.

"Larval stages number three (or four)." R. H.

REPORT OF THE NEW JERSEY STATE AGRICULTURAL EXPERIMENT STATION UPON THE MOSQUITOS OCCURING WITHIN THE STATE, THEIR HABITS, LIFE HISTORY, ETC.—BY JOHN B. SMITH.

It is not often that two so large and excellent works on the same subject appear almost simultaneously as those of Doctors John B. Smith and E. P. Felt on the mosquitos of their respective states. Dr. Smith's report is of 482 pages, illustrated by 133 figures (mostly full page plates) with maps of various sections. It is divided into four parts: I. "Mosquito Characteristics and Habits"—in which the larval, pupal and adult structure are shown by large figures with all the parts clearly defined, also the mouth parts and biting habits are fully described; a chapter on how mosquitos develop is followed by accounts of their hibernation, their relation to disease, and how to study, collect, and preserve them. Part II is devoted to their natural enemies, remedial measures and destructive methods. Part III, on classification, occupies pages 149 to 364; tables for determining the adults and larvæ are followed by full descriptions of the species, their life habits, distribution, etc., and exceedingly beautiful drawings of both the imago and larva, supplemented by enlarged figures of parts essential in classification. Thirty-seven species are described, and many of the species figured for the first time.

The author is to be congratulated on making a work thoroughly scientific, yet popular in the way it is presented. Generic frills are avoided, and a series of common names adopted, which will undoubtedly appeal more to the public and create a general interest not otherwise attained; thus with the co-operation of all enterprising citizens the mosquito nuisance can to a great extent be mitigated. The closing part treats of "local problems and surveys." The principal breeding places throughout the state are designated, and what has already been done and what should be done is clearly pointed out.

C. W. J.

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PROCEEDINGS OF THE CLUB.

The Annual Meeting was held at 194 Clarendon St., on the evening of January 17, 1905. President Emerton in the Chair; 18 members present. Officers for the ensuing year were unanimously elected as nominated by the nominating Committee, the list being as follows:

President, J. H. Emerton;
Secretary, J. W. Dow;
Treasurer, Roland Hayward;
Members at large of Executive Committee, P. G. Bolster, C. W. Johnson.

Messrs. F. Goeben, Donald Munro and A. C. Burrill were unanimously elected to membership.

Mr. Emerton exhibited an enormous mat of cocoons of the bee-moth, attached to the side of a hive. This was Mr. Bowditch's contribution to the evening's program.

Mr. Morse told of his recent examination of the Orthoptera taken in the Bahamas by Dr. Allen and his associates, and exhibited specimens. He also spoke briefly of his studies of Orthoptera from the western peninsula of Michigan, obtained by an expedition under the direction of Dr. C. C. Adams, and of some other interesting forms from North Carolina.

Mr. Johnson showed a specimen of *Ulolodes quadripunctatus* taken by Mr. J. A. Cushman at Manomet, Mass. This is apparently the first New England record for this insect.

Mr. Frost showed a specimen of *Zeuzera pyrina* taken in Medford, Mass., in 1903,— the first specimen known to have been taken near Boston.

After a short recess, during which refreshments were served, Mr. A. H. Clark gave an interesting account of some of his West Indian experiences; and Mr. Hayward told of the receipt from Utah of three more asymmetrically punctured examples of *Bembidium scudderi*, like that described recently in Psyche.

The meeting was then adjourned.

At the February meeting, held February 21 at 43 Tremont St., Mr. C. V. Blackburn was unanimously elected Secretary in place of Mr. J. W. Dow, resigned; and Mr. Guy W. Lucas was unanimously elected to membership.

PSYCHE

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IDENTIFICATION OF SPECIMENS.

The Cambridge Entomological Club is prepared to undertake the identification of adult forms in all orders, free of charge, for paid-up subscribers to PSYCHE. The privilege of retaining specimens after identification, for insertion in the collection of the Boston Society of Natural History, is reserved. Each specimen submitted should therefore have a label bearing a number or other distinguishing mark, and the sender should keep a memorandum of these labels,

MEETINGS OF THE CLUB.

A regular meeting of the Club is held on the third Tuesday of each month (except July and August) in the room of the Appalachan Mountain Club, 1050 Tremont Building, Boston. Meetings begin at 7.45 P. M. Entomologists visiting Boston are cordially invited to be present.

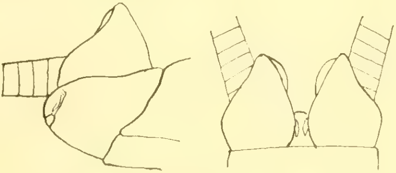
NEW GENERA AND SPECIES OF PERLIDÆ.

BY NATHAN BANKS, WASHINGTON, D. C.

In going over my collection of stone-flies preliminary to a revision of the species, I found three new generic forms; one of them has just been described by Mr. Needham as *Peltoperla*; the two others are here described, as well as a few new species.

Perla attenuata n. sp.

Pale dull yellow; antennæ dark, paler on base; pronotum rather dull brownish; apical half of the abdomen brown; setæ brown, paler toward tip; wings hyaline, veins yellowish brown. Posterior ocelli rather closer to each other than to the eyes, and fully as far from the anterior ocellus; pronotum very broad, not much narrowed behind; anterior wings rather narrow, the discal cell is very slender and attenuate at base, the radial sector not bending out when arising from the radius as in other species, but running straight out or even curving forward a a little so that the discal cell is very narrow for a considerable distance; many median and cubital cross-veins; radial sector with four branches in one specimen, three in another, beyond the cross-vein. The male genital area is concave, and between the bases of the setæ is seen a pair of small, shining hamules, or hooks, pointing forward. The ventral plate, which is rather broad, has an elevated transverse shining spot in the middle, and from each side of which a furrow extends outward and upward. Expanse 47 mm. Two specimens from Douglas Co., Kansas, June and July.



Side. Top

PERLA KANSENSIS ♂

Perla kansensis n. sp.

Pale yellowish, ocelli on black spots, a faint dark cloud on each side of the disk of pronotum, and the tip of the abdomen is brown; wings pale yellowish hyaline, venation wholly yellowish. Head broad, ocelli forming an equilateral triangle, and the posterior ocelli as close to eyes as to each other; pronotum narrowed behind, anterior angles acute, posterior ones rounded; legs short, the tibiæ plainly broader than usual, slightly swollen in middle. Discal cell arising beyond the second cross-vein of median area; the radial sector usually twice forked beyond the cross-vein. In the male the tip of the abdomen has a large conical tubercle above base of each seta, which viewed from below and behind is seen to be bilobed at tip. Expanse (♂) 35 mm. Douglas Co., Kansas, August.

Perlinella cinctipes n. sp.

Head yellow, a broad, black intra-ocellar spot extending forward, and also laterally. Posterior ocelli as close to eyes as to each other, and fully as far from the anterior ocellus. Antennæ yellowish on basal part, beyond brown. Prothorax black, with a narrow median yellowish stripe; rest of thorax brown; legs yellowish, tarsi brown, femur I with a dorsal black streak, femora II and III with a broad black band. Abdomen brown above, pale below, but darker before the tip; setæ pale, joints tipped with brown, slender, and with a few long hairs at tip. Wings faintly brownish, venation pale, costal area yellowish, radial sector with one branch, arising farther out than in *P. placida* Hag. Length 10 mm., expanse 18 mm. Two specimens from Onaga, Kansas. Readily distinguished from *P. placida* Hag. and *P. decipiens* Walsh, by the broad black bands on femora II and III.

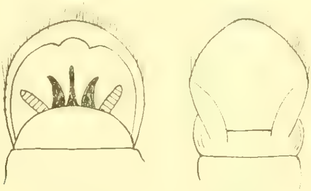
Atoperla n. gen.

Caudal setæ present, slender, with elongate joints, each tipped by a whorl of long hairs; with two ocelli, nearly as far apart as from the eyes; a folded anal space to hind wings; radial sector with but one branch beyond cross-vein, about three cross-veins beyond end of the subcosta. Type *Perla producta* Walsh. By its two ocelli it is allied to *Neoperla*, but differs from that genus by the nature of the setæ which are similar to those of *Perlinella placida* Hag., in fact I think the structure of the setæ is of more value than the number of ocelli. *Peltoperla*, the other genus with two ocelli, has very short setæ; its one species, described from New York, also occurs in West Virginia.

Tænionema n. gen.

Setæ practically absent, very short. Tarsi with three sub-equal joints, the second as long as first, and the third a little longer than others. In both pairs of wings the subcosta is connected to the costa by three or four cross-veins, and in all wings there is a strong, oblique cross-vein beyond the end of the subcosta, which with the other veins near by tends to form an X, not however as distinct as in *Nemoura:* in the fore-wings the cubitus at end of series of cross-veins curves upward toward the branch of median vein, thus forming a very large cell. Type —*T. analis*

This genus combines the characters of *Nemoura* and *Tæniopteryx*, especially that section of *Tæniopteryx* called *Rhabdiopteryx* by Klapalek. It differs from all *Tæniopteryx* groups by the strong cross-vein beyond the subcosta, a character of *Nemoura;* from *Nemoura* it is well separated by the long second tarsal joint, and the costal cross-veins, the latter character found also in *Rhabdiopteryx*. The subgenital plate of the male is much like that of the European *Œniopteryx loewii* Alb., but still larger.


Above. Below.

TAENIONEMA ANALIS

Genitalia ♂

Tænionema analis n. sp.

Head shining blackish, with a pale spot in the middle, and another on clypeus; antennæ uniform dark brown; pronotum mostly blackish, but the sides rather broadly yellowish, not strongly rugose; rest of thorax black; a pale spot in middle of base of the mesothorax; abdomen black, subgenital plate yellowish; legs pale yellowish, tarsi darker; wings hyaline, venation dark. Length 13 mm., expense 24 mm. From Ft. Collins, Colorado, 31 March, and Las Vegas, New Mexico (Cockerell.)

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—LX, LXI.

BY HARRISON G. DYAR, WASHINGTON, D. C.

LX. *Melanolophia canadaria* Guenée. I have distinguished the Eastern and Western races of this species in an article on the fauna of the Kootenay District of British Columbia (Proc. U. S. Nat. Mus., XXVII, 910, 1904); the larvæ here described are those of the Western race.

Egg. Elliptical, flattened, depressed, truncated end rounded and only slightly flattened; reticulations fine, formed by the edges of concave pits which are irregularly hexagonal with no defined pattern except centrally, where the egg is somewhat constricted; they tend to line in longitudinal rows; they are distinctly raised, but have broad bases. Bluish green, slightly frosted, later shaded and spotted with pink at the truncated end. Size .9 x .6 x .5 mm. Most of the eggs were laid stuck under a piece of paper and they are probably laid in nature in the crevices of the bark.

Stage I. Head rounded bilobed, higher and wider than joint 2, pale testaceous, eye black, mouth brown. Body rather short, normal, actively looping. Pale green, with dorsal, subdorsal and lateral smoky olivaceous bands, stigmatal region broadly pale; a broken subventral line and ventral band of smoky. Shields concolorous, but without the lines; tubercles and setæ concolorous, obscure; setæ short, white, capitate; feet pale.

Stage II. Head rounded bilobed, luteous, eye black, mouth brown; width .6 mm. Body normal, moderate, smoky greenish, finely obscurely lined in whitish, appearing as before. The pale lines are addorsal, subdorsal, lateral and stigmatal. Cervical shield lined, anal plate with whitish edges. Tubercles pale, hair dots and setæ black, small.

Stage III. Head rounded, bilobed, clear orange yellow with faint dusky mottlings on the lobes, ocelli black; width 1.05 mm. Body moderate, not elongate, pale green, the anal end orange tinted. Stripes broad, dusky olivaceous, obscurely geminate by their edges; dorsal, subdorsal, lateral, suprastigmatal, subventral and ventral, leaving the substigmatal space obscurely whitish. Tubercles and setæ small, black.

Stage IV. Head rounded bilobed, full, yellowish green, setæ black: width 1.6 mm. Body moderate, not elongate, anal feet large, spreading. Green, the addorsal line pale, darker green filled, subdorsal pale; sides faintly darker with a pale waved lateral line close to a broad yellowish white stigmatal one; venter dark, shaded with pale subventral and broad medio-ventral bands. Feet pale; tubercles concolorous, setæ short, dark; no shields.

Stage V. Head bilobed, flattish before, oblique; light green, faintly reticulate, ocelli in part black; width 2.6 mm. Body cylindrical, moderate, smooth, light green, the color of the young needles, slightly white shaded, leaving a dorsal line of darker green edged by the white. Subdorsal and substigmatal lines white, moderate, equal; faint traces of a waved lateral line; subventral and geminate ventral line yellowish, very faint. Tubercles obsolete, setæ dark, fine; spiracles ochraceous; feet green, smoky tipped; no shields.

The larvæ, when mature, became reddish and entered the ground to pupate. Eggs June 4, mature larvæ July 9; single brooded, hibernation in the pupa. The larvæ fed on the needles of spruce, eating only the pale ones of the same year's growth, which they closely matched in color. Larvæ from Kaslo, British Columbia.

LXI. *Petrophora convallaria* Guenée. This species is not improbably the same as the European *munitata* Hübner. My specimens agree with what Guenée says of his *convallaria*, and I have no doubt that it was this form he had before him.

Egg. Rounded elliptical, no flattening, truncation and depression indicated, but rounded; smooth, shining pale yellow, reticulations barely indicated as shadowy lines, regularly reticulate; very shining; size .6 x .5 x .4 mm.

Stage I. Head cordate, pale brown, eye dark. Body slender, curled in S-shape, all dark sordid olivaceous with short capitate setæ; no shields, no marks; tubercles and feet concolorous.

Stage II. Head whitish, dotted, especially on the sides, with dark brown, eye black; width .5 mm. Body slender, elongate, translucent green from the food; broken dorsal, faint subdorsal, distinct lateral, faint suprastigmatal brown lines, the lateral line olivaceous brown. Venter finely streaked in brown; faint substigmatal, more distinct subventral and medioventral lines. Setæ very short, capitate; tubercles colorless with black hair dots. Stigmatal region and feet pale.

Stage III. Head scarcely bilobed, erect, pale luteous, a linear dotted band from the antennæ to the outer side of the vertex and second faint one within; width .9 mm. Body moderate; obscure, sordid, pale, on joints 5 to 8 a small blackish dorsal spot and two small subdorsal ones; dorsal, subdorsal, lateral and suprastigmatal faint reddish lines; subventer broadly pale, feet pale. Setæ short, with rather large glandular tips; tubercles concolorous, roundedly elevated; venter obscurely reddish lined.

Stage IV. Head rounded bilobed, white, thickly mottled with brown dots, leaving a vertical band of the ground color on the face of the lobe and one up from the eye, between which the dottings are darker; width 1.3 mm. Body moderate, the central segments not over one-third longer than broad, smooth. Light brown, the ground yellowish, mottled with purplish brown. On the central segments a black patch anteriorly and before tubercle ii and a small subdorsal one just above ii. Faint addorsal, subdorsal and lateral dotted pale lines. Stigmatal region broadly pale, sharply limited above on joints 10 to 13, with a conspicuous black patch on the base of the foot of joint 10 before. Subventral and adventral pale lines with dark shading between them. Feet pale, tubercles white, setæ short, brown. The dorsum of joints 9 and 10 is broadly pale, as also joint 5, but less conspicuously.

The larvæ are probably somewhat general feeders on low plants. They were given *Polygonum* and *Epilobium.* Larvæ from Kaslo, British Columbia.

THE BEDBUG, *CLINOCORIS* (=*CIMEX*=*ACANTHIA*=*KLINOPHILOS*) *LECTULARIA* LINNÆUS.

Part I. Life-history at Paris, Texas, with Biological Notes, and Some Considerations on the Present State of Our Knowledge Concerning It.

BY ALECANDRÈ ARSÈNE GIRAULT, WASHINGTON, D. C.

Although the habits and life of this abominable inhabitant of the dwellings of man are now tolerably well known, yet, there remain certain points in its economy which are still open questions to us. The writer does not intend to go into these very fully, but first offers some detailed notes obtained from observations made from time to time on this insect, and then tries to point out certain important, neglected phases in its life-history.

Hitherto, authors, excepting a few, have seemed inclined to rush hurriedly over the discussion of this insect, as if ashamed, and hence it has been, comparatively speaking, much neglected. It is *the* insect most directly affecting man, and the one, if any, which should be thoroughly studied, and yet, not until as late as 1896 (Marlatt, 1896 a) was its true life-history made known. After giving the following detailed notes, which may be of interest, the writer will enter a little more fully into this subject. The observations, unless otherwise stated, were made at Paris, Texas, about 33° 45′ north latitude, and though of secondary importance, they are thus detailed because definiteness on all points in the life-history of the bedbug is evidently lacking.

As the food-supply is the factor directly determining the lengths of the instars in this insect, it is *apparently* true that climatic conditions have very little significance in this respect; for any single instar in its postembryonic development may be indefinitely prolonged by the total absence of food, or may be varied at will by giving food at variable time-periods in the different instars. But, under what may be called normal conditions, in which the insect is attending a constant host, and hence, is having an optimum amount of food, the climatic conditions must necessarily influence the length of the different instars, and therefore a life-history to be at all representative must be taken when under such conditions.[a] For it is well known that the preparatory stages of ecdyses are much lengthened by cold, and much shortened by heat, most easily seen in lepidopterous larvæ. Under so-called normal conditions, then, climate would noticeably influence the length of the instars.

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[a] Compare foot-note in seq.

Egg.

1. *External development.* Five (5) eggs deposited during the evening 22nd June, showed no external changes until the morning of June 24th, when they were shaded by the yolk mass. At 8 A. M., 25th June, the embryo was plainly visible, showing buds of the appendages, the body segments, and the reddish eyes. On morning of 28th June they hatched without further changes.
2. *Length of instar.* Two observations made on a total number of thirty (30) eggs during the last two weeks in June averaged 5 days, 12 hours. Eggs confined indoors.
3. *Number deposited.* See adults.

Nymph.

1. Description of stages.

I. Length, 1.45 mm. Whole body pale, sordid yellowish-white, much paler at exclusion; eyes bright red; a dark, transverse, sub-arcuate dash on dorsum of caudal abdomen, sometimes confused; head and portions of thorax darker, subfuscous. Deep red after feeding. Antennæ 4-jointed. From many specimens, 12 hours after exclusion.

II. Length, 2.10 mm., variable. The same; sordid yellow, discus of abdomen dark from food; eyes darker; abdomen flat, depressed, wider than in I.

III. Length, 2.50 mm., variable. The same; uniformly luteus, the discus of abdomen darker from food, its margins lighter; eyes dark; abdomen oval (dorsal aspect), depressed, much wider. Exuvium entire, sordid white.

IV. Length, 3.00 mm., variable. The same; body slightly darker.

V. Length, 3.80 mm., variable. The same; body entirely fuscous.

Description from 3 specimens, made immediately after ecdysis.

2. Development.

A. A single nymph or larva hatching during the morning of June 24th and isolated in a small glass vial, was fed at once. It was very active after hatching, and at first made attempts to escape, though in a few minutes readily took food. Just as soon as the least bit of blood entered the body it could be traced to its destination, and as more was sucked in, the body became stained a very beautiful, deep, purplish red. The abdomen, at first flat and round in outline, soon became distended, lengthened, and cylindric, and the nymph then measured 2.00 mm.[a]

On the afternoon of the next day (25th), the nymph was again fed, and the abdomen was much darker, not stained as previously. Again on the morning of July 1st, it was fed. It had not changed. On the morning of July 6th, it fed long and eagerly, until the abdomen became so large and distended that it was all out of proportion to the rest of the body; it was then stained purplish red, as after the first meal. The insect after this gluttonous meal did not lose its usual activity. The first molt then occurred about 7 P. M., 7th July. It had thus fed four (4) times during the first instar.

In the second instar, it was fed for the first time at 9 P. M., 9th July but took but very little food, showing an inclination to wander and hide, and was evidently much disturbed by the strong lamp-light in the laboratory. But at 4 P. M., 13th July, it went eagerly to food, remaining as before, until the abdomen became immensely swollen, and deep cherry red. It measured after this meal, 2.5 mm. The following night, it refused to feed, and afterwards, molted for the second time at 4 P. M. July 16th.

During the third instar, the nymph was offered food at 9 P. M., 18th July, but took little or nothing. At 8 P. M., 22nd July, however, it was finally induced to feed until gorged. It then measured 3.00 mm. The third ecdysis occurred at noon, 29th July.

At 9 P. M., 29th July, it was fed for the only time in the fourth instar, measuring after this meal 3.85 mm. The fourth ecdysis occurred at 7 P. M., 2nd August, and in the fifth instar, the single meal was given at 9 P. M., 6th August. After this very long meal, the insect measured 4.85 mm.

It became adult about 6 A. M., 11th August, much smaller than its parent, and lived in confinement with food until October 8th following.

B. Another nymph hatching during the morning of 28th June, and confined as in foregoing, was fed for the first time on July 9th, or ten days after exclusion. It then molted during the evening of July 12th, and was again fed at 8 P. M., 14th July. Length after ecdysis, 2.1 mm.; after feeding, 2.5 mm. The second molt occurred at 4 P. M. 14th of July, and food was again taken at 10 P. M.; 18th July, for the only time in the third instar. Length after ecdysis, 2.75 mm.; after feeding, 3.2 mm. The third molt occurred at 6 P. M., 22nd July, and food was given three (3) hours afterwards, though with much trouble, for attempts to escape were persistently made, the insect being annoyed by the strong lamp-light. When shaded from the light, it soon went to food; this was repeated a second time. Once at food, the presence of light, apparently, did not annoy it. Length after third ecdysis, 3.25 mm; after feeding, 4.3 mm. It was showing signs of approaching ecdysis at noon, 26th July, and molted a fourth time at 7 A. M., 28th July.

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[a] The measurements of this insect agree with those given under description of the stages, and therefore the increase in size from feeding can be calculated.

In the fifth instar, it was fed at 9 P. M., 29th July. Length after ecdysis, 4.3 mm.; after feeding, 5.00 mm. The final (fifth) ecdysis occurred on the morning of August 3rd. Length after ecdysis, 5.00 mm. It died in confinement without food on 13th September.

It is apparent from this, that measurements of length after a full meal, approximate the length of the insect after the ecdysis following this meal. For example, a nymph measuring 5.0 mm. after a full meal in instar V, would measure approximately 5.0 mm. when adult. It is also indicated that more food is needed in the first instar, than in the rest. A single meal suffices, apparently for all instars after the first, a conclusion drawn from four (4) individuals reared during different periods throughout the season of 1904.

3. Length of instars.

The following table, summarizing the instars of four individuals, represents durations of stages under optimum conditions, under fair conditions, and under adverse conditions, when the food supply is highly inconstant and variable. A, under optimum conditions, having a constant host, was fed as soon as possible after each ecdysis, as the nymphs naturally do, if possible. B and C, under so-called fair conditions, were fed at shortly varying time periods, representing an intermittent host; they were fed at the same time, until in instar III, C refused food, and thus dropped behind. D, under adverse conditions having a periodical host, was fed at greatly varying time-periods, at first, more for the purpose of causing very unequal instars to show the relation of food supply to development, than for anything else, and was afterwards included in this table.

Table of instars of four individuals, the food-supply variable.

Instars	Hatched A. M., 24th June.										Hatched A. M., 28th June.							
	A*				B†				C				D					
	Days	Hours	Molts	Meals	Days	Hours	Molts	Meals	Days	Hours	Molts	Meals	Days	Hours	Molts	Meals	Ecdysis
First	13	10	7 p. 7 July	a. 24 June p. 25 June a. 1, 6 July	14	12	10 p. 12 July	9 July	14	12	10 p. 12 July	9 July	35	0	a. 2 Aug.	9 p. 14 July 9 p. 29 July	1
Second	8	21	4 p. 16 July	9 p. 9 July 4 p. 13 July	3	18	4 p. 16 July	8 p. 14 July	3	20	6 p. 16 July	8 p. 14 July	6	0	a. 8 Aug.	9 p. 6 Aug	2
Third	11	20	Noon 28 J'y	9 p. 18 July 8 p. 22 July	6	2	6 p. 22 July	10 p. 18 July	9	18	Noon 26 J'y	10 p. 18 July 9 p. 22 July	36	12	10 p. 13 Sep.	9 p. 8 Sep.	3
Fourth	5	7	7 p. 2 Aug.	9 p. 29 July	5	13	7 a. 28 July	9 p. 22 July	22	0	17 Aug.	9 p. 13 Aug.	13	20	6 p. 27 Sep.	10 p. 23 Sep.	4
Fifth	8	11	6 a. 11 Aug.	9 p. 6 Aug.	6	0	a. 3 Aug.	9 p. 29 July	28	0	14 Sept.	9 p. 8 Sep.	66‡	18‡	Noon 3 Dec.	9 a. 17 Nov.	5 (adult)
Sums	48	8		10	35	21		5	78	2		6	156	2		6	

* Cf. A. ante.

† Cf. B. ante.

‡ Approximated.

Note.—a. and p. stand for A. M. and P. M. respectively.

A, although under optimum conditions, and cared for better than the others, did not reach its full growth until thirteen (13) days after B, which was fed less frequently. This serves to show, that no matter what the conditions, even if uniform for many individuals, the instars would vary considerably for the individuals. If comparisons are made with the foregoing, however, it will be seen quite readily, that the difference between A and B is due to difficulty in feeding A, owing to the latter's individual incapability of taking sufficient food at a single meal[a].

4. Feeding habits; some considerations.

The nymphs are very voracious, and at a single meal gorge themselves until unable to hold more. The time therefore given to each meal is limited by the capacity or size of the nymph at the time of any one meal, the capacity of course depending upon, or rather being more or less bounded by, the different instars. Hence, in each instar, the time taken for any single meal is more or less definite, shorter in the earlier, longer in the later instars, as the capacity is less in the earlier, greater in the later instars.

For its first meal after hatching, in instar I, it requires on the average, about three (3) minutes to glut itself, and if another meal is taken in this instar, a slightly longer period. In instar II, five (5) minutes; in instar III, six (6) minutes; in instar IV, eight (8) minutes; in instar V, ten (10) minutes, and when adult, from ten (10) to fifteen (15) minutes. These may be taken as averages, as the time for individuals varies somewhat.

As the nymphs very rarely take more than a single meal during an instar, probably being unable to do so, in many cases, before developmental processes hurry them on to another ecdysis, and as the adults are apparently unable to feed again after a full meal for at least forty-eight (48) hours, it is strongly indicated that visits to the host are limited in point of time to that consumed in obtaining a full meal. This varies, as has been shown, from three (3) to fifteen (15) minutes according to age.

Limited observations covering a period of three years would seem to confirm this comforting fact, but it cannot be stated as a definite certainty. It is, however, in the writer's opinion, highly probable. But if the bugs are at all numerous, the generations being considerably mixed, the host would doubtless have visitors each night.

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[a] The length of time required to rear these two nymphs compares favorably in regard to climate, with the 49 days required for those reared at Washington, D. C. See Howard (1901.)

As the writer could not conveniently obtain a suitable substitute-host to supply the necessary amount of blood upon which to rear these insects, he was forced himself to feed them from portions of the forearms, and from the hand and tips of the fingers.

When punctures were made on the upper portion of the forearm near the wrist, neither pain nor swelling resulted. But in the case of the adult, and nymph V, a distinct itching sensation was felt, somewhat like prickly heat but the other symptoms of inflammation did not appear. The itching was hardly noticable, even though the cause was certain. As far as the writer is concerned, therefore, no indications of attack are present. And this is so with others.

On the other hand, many persons know at once when these insects are present, from the intolerabble itching which ensues from their attack, and from the inflamed spots which afterwards appear. It is evident that this latter class forms but a small proportion to the whole, a conclusion drawn from the known prevalence of this pest in really respectable places, and from the indifference which is shown to its presence.

5. Length of life in confinement without food.

Thirty (30) nymphs, hatching on the morning of June 24th, and at once confined in a dry glass vial, cork-stoppered, measuring 2.5 cm. long by 1 cm., lived until the 2d of August, or thirty-nine (39) days. Two (2) nymphs hatching during the night of 22nd of June, and confined in a larger glass vial (4.5 cm. by 1.cm.) lived until the 26th of August, or sixty-five (65) days. Both lots were confined in the laboratory, where the temperature ranged a few degrees lower than natural.

Adults.

1. History and oviposition.

Two fully fed females, taken from an old wooden bedstead, in an apartment house, were confined at 10 P. M., 17th June, separately, in small pill-boxes. One was fed, the other not. The first gave rise to the nymphs in foregoing. The other deposited but very few eggs and soon died.

The record of deposition, and the effect of feeding on the number of eggs deposited, is tabulated for convenience, as follows.

Record of oviposition of two females, confined at 10 P. M., June 17th, when fully fed.

A—Fed				B—Unfed		
Date	No. Eggs	Meals	Length life	Date	No. Eggs	Length life
18-21 June	34			18-21 June	2	
21 "	1			21-22 "	2	
22 "	5	22 June		22 "	1	
24 "	1			23-27 "	2	
29 "	2	29 June				
1-6 July	5	6 July				
7-9 "	7	9 July				
9-12 "	18					
12 "	5					
13-16 "	3					
18-22 "	2	18 July				
22-24 "	8					
28 "	11					
30 July-5 Aug.	3	29 July				
8-12 "	3	6 August				
19 "	3	13 August				
6 Sept. Died	111 eggs	8	81 days	12 July died	7 eggs	24 days

Thus, the effect of food on the rate of ovisposition and also on the length of life is plainly indicated, but from the fact that but two individuals were used, nothing conclusive can be drawn.

It would also seem to indicate that but one principal brood occurs through the season, or that the females continue to lay at periods during the main breeding season, as in the case of *Anasa tristis*. It may be noted that these females when captured had already deposited some of their eggs.

2. Length of life in confinement with and without food.

It is often mentioned that these insects can survive for months without known food. This has been established by confining single specimens in closed vials or boxes, and leaving them undisturbed. Writers disagree on this subject, and extended breeding experiments are necessary before it can be definitely settled.

But few observations were made bearing on this, but it may be well to put them on record in this connection. A fully fed female, confined after capture, in a closed pill-box, lived twenty-four (24) days without food, during June and

July. Another; full-fed in instar V, but starved after the final molt on August the 3rd, died on September 13th after living forty-one (41) days. At Blacksburg, Virginia, in 1902 an adult confined in an ordinary pill-box, as in the foregoing, and kept in a cool room in a laboratory, live seventy-five (75) days without food, from August to November. Here, low, fall temperatures doubtless lengthened its life.

With food, a single (1) fertile female lived in confinement eighty-one (81) days, from June to September; it was captured in an an infested bed, and had evidently been adult for several weeks prior to capture. Another, reared in confinement, lived as adult with food, from August 11th to October 8th, or fifty-nine (59) days.

At Blacksburg, Virginia, an adult confined as usual, and fed once at the end of the first thirty (30) days, and from thence unfed, lived two hundred and fifty-nine (259)days or about eight and a half months. This was from August, 1902, to May, 1903. Low temperatures, again, doubtless account for this great increase in length of life. The insect was numb for a greater part of the time, and several weeks before its death declined food, apparently unable to take it. (Cf. DeGeer, 1773, pp. 304–305).

From these records, though meagre, and from other considerations, the writer cannot help thinking that this insect lives normally but a single season as adult, or that it is single brooded in habit. Professor Herbert Osborn, in a letter, informs me that this is also his belief.[a] The important fact apparently indicated, is that the activly reeproducing males and females survive but the actual breeding season and do not live over the following season, at least to continue reproduction. These of course, are but suggestions, and cannot be at present fully substantiated.

3. Feeding habits in confinement; general notes.

Nothing of importance was noted in regard to feeding habits, excepting perhaps that females when once full-fed, were unable or unwilling to feed again within thirty-six (36) hours, or longer.

As very many *definite* statements have not been published concerning the general habits of the bedbug, a few notes in this respect may not be amiss in this connection. The writer had some very unpleasant experiences with these

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a. January 30th, 1905. Others have also stated this (Lugger, 1896) though giving no data upon which it is based.

insects during a summer's stay in a small town in Virginia. The whole place was thoroughly infested, and it was not an uncommon thing to see mattresses and bed-slats turned out to air, which were literally white with the insect's eggs. The writer's room was as bad as the rest; the old-fashioned bedstead was full of them, while during the day scores of them could be detected hiding in the walls. The place was almost unbearable, for the insects were not satisfied in staying indoors, but were frequently found secreted in one's clothes. One night, returning to the room from outside, two were found beneath the collar, while occasionally, one would be found hiding within a pamphlet which was carried in my pocket. Wherever they were very numerous, many could be found frequenting privy-houses or other similar places, where they would be sure to obtain an occasional meal, visiting the host at every chance, night or day. That these insects are very active and freely move from place to place, that is to say, not necessarily confining themselves to certain rooms or houses, and hence not directly dependent upon any one host, is evidently true. Mr. William F. Fiske informed me that when stationed at Tryon, North Carolina, while working in the laboratory at night, bedbugs would crawl along the under sides of the edges of the table and stealthily approaching his bared arms, would attempt to feed.

At Washington, D. C., bedbugs were active during December, 1904, until January, 1905. Nymphs in instar I, were found concealed within clothing hanging in a closet; they were active and had been feeding. Adults and large nymphs, recently fed, were also found during those months[a]. During the last week in December, 1904, adults were observed in the middle of the night crawling from their hiding-places in the walls of a brightly lighted room, evidently in search of a host. On another occasion, about the same time, an adult was surprised in the act of visiting a host at 7 P. M., in a warm and very brightly lighted room. It was feeding from the side of the face, and darted quickly away when the host stirred in his sleep; it was found to be well gorged with blood. These observations were made in supposedly respectable boarding-houses, where the presence of this insect was unknown, or at least not commented upon, by the other guests.

Some important neglected points in its life-history.

1. Its relation to Man from medical and sanitary points of view.

Professor Herbert Osborn, in a letter dated January 30th, 1905, says,

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[a] Southall (1730) makes the following, original observation: "And I have seen, and do assert, they do bite in the cold as well as hot seasons." p. 28.

"It is quite remarkable that so little accurate and positive knowledge is available regarding an insect that is so universally distributed. I have brought out in class lectures the probability of the transmission of diseases by this insect, but do not recall references or definite recorded instances proving any such distribution."

The inoculation of the host with virulent blood diseases by this insect, seems to the writer to be of the highest possible degree of probability, and of the greatest importance to the people at large; and yet up to the present time nothing very definite is known, or has been done (excepting negative experiments) in the way of clearing up this point. But comparatively few references to anything of the kind could be found. A most interesting article was published in the Medical Record (Dewèvre, 1892) and is quoted in Insect Life (Riley and Howard, 1893 a).[a] The baccilli of tuberculosis were found in bedbugs attending a tuberculous host, who slept in a bed formerly occupied by his brother who died of the disease The host was observed to have been bitten by the insects in question. The room excepting the bed had been throughly disinfected. Although suspicious, nothing conclusive is proven by this, as the second host may have contracted the disease in other ways under such circumstances, as for instance from dried sputum on the bed, or from direct association with his brother.

It is not the writer's intention to go further into such considerations, but simply to call attention to the great importance of this question from medical and sanitary points of view. It is just as easy, if not easier, to conceive of the transmission and inoculation of highly dreaded blood diseases by bedbugs, as it is to conceive of the transmission of yellow-fever and malaria by mosquitos (*Culicidæ*), or of the spread of disease germs by houseflies (*Musca*). And these latter have been definitely proven. Then is it not fair to suppose that, taking into consideration the much closer interrelations of insect and host and the former's great abundance, universal occurrence, and constant presence[b], bedbugs have a much greater part to play in the spread of highly contagious diseases than do either mosquitoes or flies? That is a question that should be answered as soon as possible, and especially by the medical profession[c].

2. Other unknown, neglected, or indefinite points in its life-history.

For the sake of brevity, these will be passed over as rapidly as possible. The number of annual generations has not been definitely settled, and very little is apparently known in this respect. It will be a rather difficult point to decide from the nature of the case, and is not of great importance, economically.

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[a] And also stated by Alleger (1894).

[b] As for instance, in the slums of cities and in brothels.

[c] Vide Craig (1898), Titkin (1897), and the references given by them, and cf. the very important historical and original papers by Nuttall on this subject.

Adult length of life, and especially in regard to the two sexes, is a much mooted question, and is always confused with longevity or mere existence without known food. It is used here to include actively breeding adults under normal conditions. The male is supposed to take no food (Curtis, 1835), or at least no blood. Nothing is known of this.

In regard to longevity, many theories have been promulgated to explain or account for it. Food other than human blood is supposed to account for it, and also cannibalism. Yet, how did the specimens which DeGeer (1773) confined for over a year in a "sealed bottle,"[a] obtain juices upon which to subsist? Or those confined in closely-fitting paper boxes, such as ordinary pill-boxes? All authors[b] agree in stating that they can exist for many months without known food, but when citing instances, as for example, their supposed occurrence in large colonies in houses which have been long unoccupied, always theorize in regard to some food in order to account for it.

The lack of definite statements in regard to such occurrences, precludes further discussion. It is obvious that such infested houses would have to be isolated, or else the insects would move to others. It is also obvious that such occurrences can be accounted for by confusion with other closely allied species of *Cimex*, or in the case of new-comers, by unconscious transportation of the bed-bugs themselves. DeGeer (1773) has proven that the insects can exist for many months without food, and this is an easy way in which to explain the matter. If the insects were cannibalistic, obviously, large colonies would not thus be found. The confusion exists because of the lack of details. Their food-habits are thus left in obscurity, under the conditions spoken of, together with the question of longevity.

It may be of interest to quote Lintner (1885) as a case in point. A correspondent wrote as follows: " 'Will you tell us something about the bed-bug, what its habits are, when it "spawns," what it eats, how long it lives, and if it ever dies? I ask because I have moved into a house that I find was already occupied by several colonies of the pest. The room in which I have my library has the most. They are in my files of papers and periodicals. They seem to grow fatter every day, but for the life of me, I cannot tell what they live on. * * * * * * *. Can it be that they live on the paste on the wall paper? As for remedies, * * * * * *. The latter (red pepper), I have sifted through my papers and books, and wherever I could get it; but instead of driving them off, they seem to fatten on it; * * * * * * * * * * * * * * *. * * * *.'" pp. 16–17.

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[a] Quoted from authors. In reality, the insects were kept in a sand-box (*un poudrier*) presumably those used DeGeer's time to sprinkle writing with sand in order to dry it. It should also be noticed that the insects lived most of the time during the winter or cold months. Southall (1730) states that they feed on oak, walnut, cedar, etc., and in his recommendations, tells us that such woods should be avoided about dwellings.

[b] Excepting Dufour (1833).

This appearance of the insect in an unoccupied (i. e., not a sleeping) apartment, is apparently explained by Lintner, by the fact that they obtained nourishment from moisture in the paste on the wall, or, and so forth. But as the insects were stated to be fat,[a] it is evident that they were merely hiding in the books and papers by day, and visiting the hosts by night, or whenever a chance offered. Their occurrence in an unoccupied house may be explained in many ways, and may not have been of long duration. Lack of details, such as the appearance of the insects when found, whether fat or thin, dark or light, the conditions under which found, and so forth, makes positive conclusions impossible.

An appropriate quotation also may be taken from Dr. Howard (1901), in which it is to be noticed that no reference is made to a questionable supply of food when referring to longevity. He says: "It has gained the power of subsisting almost indefinitely without food, waiting for its meals with a patience far surpassing that of Job." p. 289. And then again: "And then, too, from the ability which the bedbug has of undergoing prolonged fasts, it may be found alive not only in houses hich have been deserted for a long time, but about old deserted camps in the woods." p. 290.

The period of oviposition and the number of eggs deposited are also unknown, especially the latter. Southall (1730) stated that eggs were deposited about four (4) times during the year in batches of fifty (50), and he has evidently been followed up to the present time. Riley (1887), a century and a half later, states that the female deposits about fifty (50) eggs in March, May, July and September, but does not give a more definite statement, and is apparently following Southall. Butler (1893) says the same, indirectly quoting Southall, and this statement has been copied quite generally. Further than this, nothing has been done.

It may be well to call attention to the fact that no true parasites have been recorded as attacking the bedbug, though it would not be at all surprising if such were found attacking the egg, which are more exposed than the later stages. It has been a long accepted fact that none were present, and later writers, under such circumstances, may have easily overlooked minute egg-parasites. Its anatomy has been well worked up (Landois, 1868; D'Herculais, 1886; and others.)

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[a] It can hardly be believed that these insects would be fat, if nourished on moisture alone. When deprived of blood for long periods, they become thin and transparent, or at least much lighter in color, even in the presence of moisture.

The trouble then is, that definitely stated facts are wanting concerning much of the life-history of this pest. This has doubtless been caused, partly on account of its being so common everywhere, and having an extensive literature, thus causing modern writers to believe it at first glance to be well studied, and partly because of its odious character and abominable nature. The last cause seems to have the most to do with it.

For those who may want to look fully into the questions suggested, a full bibliography of the literature is appended to this paper. This has been made as complete as possible, and on account of its length, will follow as part II. It is hoped that the list of titles given, will be found very complete and accurate, the writer having made it a point to correct the many erroneous references existing and to verify those which have been found to be correct. The bibliography will be explained, the titles criticised and credit given in their proper places.

Thanks are here extended to Dr. L. O. Howard, Chief of the Bureau of Entomology, United States Department of Agriculture, for permission to publish these notes; and for other kindnesses.

SYNOPSIS OF THE TIPULID GENUS BITTACOMORPHA

BY CHARLES W. JOHNSON.

This interesting genus is very widely represented by the more common and conspicuous species *B. clavipes* Fabr., which extends throughout Eastern North America from the Atlantic to the Rocky Mountains. All the records from the Pacific Slope undoubtedly refer to *B. occidentalis* Aldrich (Psyche VII, p. 201, 1895) and Osten Sacken (Psyche VII, p. 230, 1895). The *B. sackenii* described by von Röder from Nevada (Wiener Entom. Zeit., Heft 8, p. 230, 1890) has also been recorded from Seattle, Washington, by Aldrich and re-described by him in Psyche VII, p. 200. A specimen from the mountains of North Carolina adds another species to our fauna.

TABLE OF SPECIES

1. Tibiæ annulated with snow white near the base. 2
Tibiæ not annulated, all the metatarsi white at the tip instead of the base. *sackenii* Röder.

2. Metatarsi more or less swollen. 3
Metatarsi not swollen in the slightest degree, nor annulated at the base, and only those of the anterior tipped with white. *jonesi* n. sp.

3. Dorsum of thorax deep velvety black with a white median line. *clavipes* Fabr.
Dorsum of thorax shining black, the white median line wanting. *occidentalis* Aldr.

Bittacomorpha jonesi n. sp.

♂ Head blackish, front and face covered with a silvery white pollinose; antennæ about 4mm. in length, the two basal joints brown, the remainder black and strongly pubescent; palpi and proboscis yellowish. Dorsum of the thorax shining black, the remainder of the thorax including the scutellum dull yellow, slightly darker on the pleuræ; humeri, a lateral stripe extending to the base of the wing and pleuræ silvery white pollinose. Abdomen clavate, black, shining, posterior margins of the second, third and fourth segments, and the genitalia yellowish, the claspers black. Coxæ light yellow, base of the femora brown becoming gradually black toward the end; tibiæ black, annulated with white near the base; anterior metatarsi tipped with white, the others entirely black; the second and third joints of the tarsi white, the terminal joints black; halters dark brown. Wings grayish hyaline, the relative length of the second submarginal cell the same as in *B. clavipes.* Length of body 8mm., of wing 7 mm., and of the posterior legs 15mm.

One specimen from Mt. Taxoway, North Carolina, at an elevation of between 3000 and 5000 ft. Collected in August, 1904, by Mr. Frank M. Jones of Wilmington, Delaware, to whom I dedicate this interesting species.

VARYING ABUNDANCE OF CERTAIN BUTTERFLIES. Many collectors of butterflies in New England have noticed the remarkable scarcity of *Anosia plexippus* during the last five or six summers, but little or no mention of this phenomenon has appeared in print. Since 1899 I have found it impossible to obtain supplies of larvæ for class-room use, where previously the species had swarmed. In Alstead, N. H., the almost total disappearance of the species was remarked even by non-entomological observers. In 1899 it was common; in 1900 hardly a specimen could be found. Last year a diligent search revealed four of them in a region where they used to abound.

Current comment among members of the Cambridge Entomological Club suggests that *Aglais milberti* is rapidly increasing in abundance, particularly in eastern Massachusetts. My own observations seem to support this idea.

Laertias philenor appears occasionally in great numbers in the neighborhood of Boston, but after a season or two of plentifulness it vanishes. Along the southern border of New England, *Papilio thoas* and *Callidryas eubule* come and go. The range of each species widens and shrinks and widens again in response to certain changing conditions, but our knowledge of those conditions is very fragmentary. It would be interesting to compare a large series of observations, and perhaps such a comparison would help us to a better understanding of the struggle for existence among the butterflies.—W. L. W. FIELD.

RECENT ENTOMOLOGICAL LITERATURE.

A CATALOGUE OF NORTH AMERICAN DIPTERA. BY J. M. ALDRICH. (Smithsonian Miscellaneous Collection, Vol. XLVI, Pages 1–680, 1905.) About twenty years have elapsed since the publication of Baron Osten Sacken's catalogue of the North American Diptera. A catalogue such as the author now presents is one of the greatest *stimuli* to the study of any group, and it should be possible to have such works bearing on all of the orders published more frequently.

This work has the same faunal limits as the Osten Sacken catalogue of 1878, *i.e.* south to Panama and including the entire West Indes.

The first and natural question to be asked was, "How many species are there in the new list?" This I could not answer, for double the number contained in the Osten Sacken catalogue does not convey a very clear idea of the number of species recorded, so that an actual count seemed to be the only solution; a single count, barring all synonyms and cross references, but including all "unrecognizable" and doubtful species, gave 8,191; if to this we add the species described in 1904 as given in the appendix (about 229), we have a total of 8,420 species. It would be safe to cancel the 420 and to say there are probably about 8,000 described species.

The author's loyalty to Baron Osten Sacken, who laid the foundation for dipterological study in America, is beyond question, while the following expression shows the true spirit in which a work of this kind should be produced: "I have been influenced by the feeling that my catalogue must represent the actual condition of classification not merely my own views." A catalogue is not the place for radical changes, "fixity" should be the guiding star, and it is only from this standpoint that I wish to criticise. When types exist we cannot ignore the species until the types have been thoroughly studied; because the types represent two species is no reason for dropping the name and adopting a more recent one, unless both species have been previously described; species should be selected by elimination, the same as genera. I refer principally to Miss Gertrude Ricardo's papers on the Tabanidae in the British Museum collection, published in the Annals and Magazine of Natural History, 1900–1902, and adopted by Hine in his Tabanidae of Ohio. This would make the following changes in the genus Chrysops *æstuans* V.d.W., 1867,=*mœrens* Walker, 1848; *atropos* O. S. 1875,=*divisus* Walker, 1848; *fugax* O. S. 1875,=*carbonarius* Walker, 1848; *furcatus* Walker, is a good species and not a syn. of *striatus* O. S.

In the Stratiomyidae there are the following omissions: *Euparyphus major* Hine (Ohio Nat. I., 112, 1901), and *Akronia frontosa* Hine (*l. c.* 113). *Pachygaster maculicornis* Hine, belongs to the genus *Neopachygaster* of Austen.

In the Bombylidae I note the absence of *Systœchus solitus* Walker, a species which seems to be quite distinct from *vulgaris*.. The name of *Hyperalonia serveillei* Macquart, presents an interesting question in nomenclature,—whether a name based on what is apparently a recognizable figure, but without a description or locality, shall be accepted. The *Bombylius philadelphicus* of the New Jersey list is a very different species from the *B. mexicanus* Wiedeman, but whether it represents Macquart's species is somewhat doubtful.

Lestomyia fallii Coquillett, and *Erax dubius* Will. seem to be omitted. *Erax albibarbis*, Macq., 1839, should be the species, not *cinerascens* Bellardi, 1861. *Holopogon philadelphicus* Schiner, is undoubtedly a synonym of *guttula* Wied. I only note the omission of *Criorhina nigra*, Will. (Synopsis, p. 214), in the Syrphidae.

A name omitted in the Dexiidae is *Metadexia flavipes* Coq. The type is in my collection, it has proved to be a synonym of *Thelairodes basalis* Giglio-Tos. We cannot blame the author for overlooking *Phorbia cepetorum* Meade, published under the title, "Annotated List of British Anthomyiidae," in the Entomologist's Monthly Magazine, March, 1882, p. 218, where he also refers to American specimens received from Professor Lintner of Albany.

I beg to differ with the author in regard to ignoring recognizable descriptions where no locality is given, noticeably, the use of *Amphicnephes pertusus* Loew, 1873, instead of *pulla* Wiedemann, 1830, and of *Ischnomyia vittula* Loew, 1863, in place of *albicosta* Walker, 1849. *Tephronota narytia* Walker, 1849, will have to be adopted in place of *ruficeps* Van der Wulp, 1867, notwithstanding the fact that of the "four specimens in the British Museum, two of them are *Chætopsis ænea* and that one of these bears Walker's label, 'Narytia'", (Osten Sacken Cat., p. 260), the description applies very clearly to the other two, and not to *C. ænea*, Wied. *Sepsisoma flavescens* Johnson, *Tephritis nora* Doane, *Ophthalmomyia bisignata* Coq., *Eudicrana obumbrata* Loew, and *Nycteribia bellardi* Rond., seem to be omitted. Considering the amount of work involved in preparing a catalogue of this kind, the omissions are very few and the author deserves all the praise it is possible to give for his careful and thorough work. C. W. J.

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Asterisks indicate descriptions of new species of American insects or of new genera.

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65. **Leigh, G. F.** Synepigonic series of *Papilio cenea* and *Hypolimnas missippus*, together with observations on the life-history of the former, 36 1904, p. 677. **Lawrence, W. H.** Some notes on the habits and life-history of *Bembecia marginata* Harris in western Washington, 5 Apr. **Manders, N.** Some breeding experiments on *Catopsilia pyranthe* and notes on the migrations of butterflies in Ceylon, 36 1904, p. 701. **Marlatt, C. L.** Report on the gypsy moth and the brown-tail moth, July, 1904, 180 no. 58. **Murtfeldt, M. E.** A new species of *Bucculatrix**, 4 June. **Pearsall, R. F.** The genus *Venusia* and its included species*, 4 Apr [New genus *Nomenia*.] **Rebel, Dr. H.** Studien Süber die Lepidopterenfauna der Balkanlander, 64 xix. 97–377. **Seifert, O.** Contributions to the knowledge of North American Arctiidae, IV (Plate), 4 Mar. **Smith, J. B.** New species of Noctuidae for 1905, No 2*, 4 June. **Swinhoe, Col. C.** (a) New species of Eastern, Australian and African Heterocera in the National collection*, 36 1904, p. 139 [New genera *Vestura*, *Xylecata*, *Pteroceropsis*]; (b) On the Geometridae of tropical Africa in the National collection*, 36 1904, p. 467 [New genera *Pseudocrocinis*, *Milocera*, *Encoma*, *Hemicopsis*, *Caradrinopsis*, *Provola*, *Gonochlora*, and *Brachytrita*.] **Turner, Dr. A. J.** A classification of the Australian Lymantriadae*, 36 1904, p. 469. [New genera *Axiologa*, *Iropoca*]. **Webster, F. M.** Note on food of *Alabama argillacea*, 4 Mar. **Williams, F. X.** Notes on the larvae of certain lepidoptera, 5 May. **Wolley Dod, F. H.** (a) Review of Dyar's Lepidoptera of the Kootenai district, 4 Mar.; (b) Preliminary list of the macrolepidoptera of Alberta, N. W. T., 4 Apr.—June.

See also Lochhead, under Economic Entomology.

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Adams, C. F. On the North American species of *Oscinis**, 5 Apr. **Bischof, J.** Beitrag zur Kenntnis der Muscaria schizometopa*, 44 liv. p. 79 [New genera *Anacamptomyia*, *Parachetolyga*, *Polychnomyia*, *Empheremyia*, *Ptilogonia*, *Dewetia*]. **Britton, W. E.** and **Viereck, H. L.** Report on mosquito investigations in Connecticut, 177 1904, pp. 253–308. **Bueno, J. R. de la Torre.** Notes on *Mixogaster breviventris* Kahl, 5 Mar. **Coquillett, D. W.** A new *Culex* from Australia*, 5 Apr.; (b) A new Cecidomyiid on cotton*, 4 June. **Du Roselle, Dr. F.** Organes genitaux des Sarcophaga, et nécessité de leur examen pour la détermination des espèces, 95 xi, 6. **Felt, E. P.** *Culex brittoni* n. sp.* 5 Mar. **Goeldi, Dr. E. A.** Os Mosquitos no Para, 181 iv, 129. **Ludlow. C. S.** Mosquito Notes, No. 3*, 4 Mar. Apr. [New genera *Reedomyia*, *Popea*, *O'Reillia*, *Heizmannia*]; (b) A new North American *Taeniorhynchus**, 4 June. **Moodie, R. L.** A new *Milesia* from Arizona, with notes on some Wyoming Syrphidae*, 5 May.

See also Baker, under Economic Entomology, and Carpenter and Gillette, under The General Subject.

COLEOPTERA.

Arrow, G. J. Sound-production in the Lamellicorn beetles, 36 1904, p. 709. **Bates, F.** A revision of the sub-family Pelidnotinae of the Coleopterous family Rutelidae, with descriptions of new genera and species*, 36 1904, p. 249 [New genera *Mecopelidnota*, *Epichalcoplethis*, *Hoplopelidnota* and *Xenopelidnota*.] **Bernhauer, Dr. M.** (a) Neue exotische Staphyliniden*, 44 liv, p. 4; (b) Neue exotische Staphyliniden*, 45 1905, Heft I, p. 9. [New American species and a new genus, *Teras*.] **Briggs, E. M.** The life-history of case-bearers: I, *Chlamys* *plicata*, **124** iv. **Britton, W. E.** Description of the larva of *Delphastus pusillus* LeC. with notes on the habits of the species, **4** May. **Casey, T. L.** (a) A new *Carabus* and *Cychrus*, with miscellaneous notes on Coleoptera*, **4** May; (b) A revision of the American Paederini*, **175** xv, 17–248 [New genera *Alerobium*, *Eucryptina*, *Pycnocrypta*, *Cryptobiella*, *Monocrypta*, *Gastrolobium*, *Lissobiops*, *Biocrypta*, *Paederillus*, *Leucopaederus*, *Apteralium*, *Abletobium*, *Litolathra*, *Lathrobiopsis*, *Lathrobioma*, *Lathrolepta*, *Deratopeus*, *Eulathrobium*, *Lathrotropis*, *Lathrotaxis*, *Pseudolathra*, *Linolathra*, *Lathrobiella*, *Microlathra*, *Polymedon*, *Sciocharella*, *Hemimedon*, *Paramedon*, *Medonodonta*, *Oxymedon*, *Tetramedon*, *Medonella*, *Leucorus*, *Pycnorus*, *Scopacoma*, *Scopaeopsis*. *Pachystilicus* *Stilicolina* and *Omostilicus*]. **Chagnon, G.** *Criocephalus obsoletus* Rand., and *Asemum moestum* Hald., **4** June. **Cotton, E. C.** Life-history notes on *Apion nigrum*, **141** v, 346. **Enderlein, Dr. G.** Die Taukäfer der Crozet-Inseln nach dem Material der Deutschen Südpolar Expedition*, **22** xxvii, 716 [New genera *Amblystogenium* and *Temnostega*]. **Fall, H. C.** (a) Two new species of *Aphodius**, **5** May; (b) Notes on some Californian Buprestidae*, **5** Mar. **Heller, K. M.** Zehn neue Käfer aus Neu-Guinea*, **45** 1905, p. 65. [New genus *Calocerambyx*]. **Hunter, W. D.** The control of the boll weevil, including results of recent investigations, **179** no. 216. **Lea, A. M.** On *Nepharis* and other ants' nest beetles taken by Mr. J. C. Goudie at Birchip*, **178** xvii, 371 [New genera *Kershawia* and *Paussoptinus*] **Muir, F.** and **Sharp, Dr. D.** On the egg-cases and early stages of some Cassididae, **36** 1904, p. 1. **Ohaus, Dr. F.** Beiträge zur Kenntnis der Ruteliden*, **45** 1905, p. 81 [New genus *Macropopillia*]. **Pilate, G. R.** Note on the finding of *Ptinus fur* and *brunneus* **5** Mar. **Schaeffer, C.** Additions to the Coleoptera of the United States, with notes on some known species*, **165** i, no. 6. **Waterhouse, C. O.** Three new Coleoptera from East Africa belonging to the Lucanidae and Cetoniidae*, **11** xv, 375 [New genera *Dicellachilus* and *Bettonia*]. **Weise., J.** Aufzählung Mexicanischer Hispinen*, **45** 1905, p. 130. **Wickham, H. F.** New species of Coleoptera from the western United States, second paper*, **4** May.

See also McCracken, under The General Subject.

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Ashmead, W. H. A new *Pezomachus* from Italy, **4** Apr. **Cameron, P.** New Hymenoptera mostly from Nicaragua*, **142** i, 46 [New genera *Kareba*, *Plagiosmicra*, *Platychalcis* and *Rekabia*]. **Cockerell, T. D. A.** (a) The bees of the genus *Nomada* found in Colorado, with a table to separate all the species of the Rocky Mountains*, **173** no. 94, Dec. 1904; (b) The Halictine bees of North America*, **3** Feb. [Review of paper by Vachal]; (c) Three new bees from the southwest*, **5** Mar.; (d) Some bees of the genus *Nomada* from Wisconsin*, **4** May. **Ducke, A.** Sobre as Vespidas sociaes do Para (Brazil)*, **181** iv, p. 317 [New species and one new genus, *Megacanthopus*]. **Enderlein, Dr. G.** Zur Klassifikation der Evaniiden*. **22** xxvii; 699. [New genus *Evaniellus*]. **Fernald, H. T.** The type of the genus *Sphex*, **5** June. **Kieffer, J. J.** Descriptions of some new Hymenoptera from California and Nevada*, **142** i, 41. **Mayr, Dr. G.** Hymenopterologische Miszellen*, **44** liv. p. 559 [New genus *Psychophaga*]. **Morice, Rev. F. D.** Illustrations of the male terminal segment and armatures in thirty-five species of the Hymenopterous genus *Colletes* **36** 1904, p. 25. **Nason, W. A.** Parasitic Hymenoptera of Algonquin, Illinois, **5** May, June.

See also Cook, under Economic Entomology, and Phillips, under The General Subject.

ANNOUNCEMENT.

In order to facilitate a return to the former practise of publishing PSYCHE on the first day of the month of publication, the June and August numbers have been combined in this double number, appearing August 1. Henceforth it will be the aim of the Publication Committee to adhere to the old rule.

Correspondents are asked to take notice that henceforth all material for publication in a given number must be in the hands of the Editors on or before the first day of the month preceding the month of publication.

ENTOMOLOGEN ADDRESSBUCH.—By W. Junk, Rathenower Strasse 22, Berlin. N. W., Germany.

Considering the field covered by this work, viz:—the names and addresses of the leading entomologists throughout the world, it is certainly very creditable to the author, and the most complete Directory along these lines which has been published. Not only are the names arranged under countries, but also alphabetically, which adds to its value and convenience. There are over 400 pages, 114 of which are devoted to a catalogue of numerous new and second-hand books, for sale by the author. H. H. N.

The address of Mrs. A. T. Slosson will hereafter be 83 Irving Place, New York City, instead of 38 East 23 Street, as formerly.

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AMARA. Being engaged in the study of this genus, I will determine specimens for collectors. These should be sent numbered. I am also anxious to obtain species in other genera of Carabidae not in my collection, from all parts of the world, and will purchase or exchange for same. Roland Hayward, Readville, Mass.

WANTED—Eggs, larvae or pupae of grasshoppers, dragon-flies, beetles, bugs, etc. Will give tropical butterflies in exchange. Denton Bros., Wellesley, Mass.

WANTED—Material for the study of the hybrid or polymorphic butterflies of the genus *Basilarchia*, including larvae or pupae of *arthemis* or *astyanax*, imagos of *proserpina* or *arthechippus* or any specimens showing unusual characters. Liberal exchange. Specimens retained will be deposited in Museum of Comparative Zoology. W. L. W. Field, Milton, Mass.

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I have a few specimens of *C. calleta* and *cinctus* to exchange for rare *Sphingidae* or Pupae of same. W. T. Buxton, 17 Walter St., Somerville, Mass.

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WANTED—Records of captures of Connecticut insects—especially the rarer species—for the preparation of a State list. Orthoptera and Hymenoptera records desired at once. W. E. Britton, State Entomologist, New Haven, Conn.

TABLES FOR THE SEPARATION OF SOME BEES OF THE GENERA COELIOXYS AND COLLETES.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

American Apidology is greatly indebted to Mr. E. T. Cresson for the careful description of some 540 new species of bees, this count excluding a few which are now known not to be valid, but including the species of Central America and the West Indies. There is, however, one difficulty in using Mr. Cresson's work, and that arises from the absence of tables; in some of the more difficult genera this becomes so serious that the worker is at times discouraged. Two or three weeks work would provide us with tables for the separation of all the Cressonian bees; in fact, I presume that they could be made in less time than that, but nobody has seemed willing to undertake the task. When recently spending a few days in Philadelphia I took occasion to make tables of *Anthophora*, *Colletes*, (males) and *Coelioxys* (females), and the two latter are herewith presented. Some non-Cressonian species which I found in the collection at the Philadelphia Academy are included; particularly Mr. Viereck's *Colletes* from Beulah, N. M., which have never been tabulated.

Colletes Latreille

Pubescence of thorax above deep orange ferruginous 1
Pubescence of thorax not brightly colored; males only tabulated . 2
1. Large; abdomen shining, without definite bands . . *thoracica* Smith.
Small; length about 10mm.; abdomen well banded . *azteca* Cr.
2. Malar space exceedingly long, at least twice as long as broad; pubescence above strongly ochraceous; legs dark red (Mass.) *valida* Cr.
Malar space not exceedingly long, but as long as broad, at least, or almost so (hardly so in the M. N. "*consors*") 3
Malar space short, obviously broader than long 7
3. The abundant hair of face clear white 4
Hair of face ochery or greyish-white; thorax above with some or many long plumose fuscous hairs; size larger than in the group following; flagellum all dark 5
Hair of face and thorax above strongly yellowish or fulvous . . . 6

4. Larger: flagellum not red beneath; hair of thorax above ochraceous; stigma dark brown; second submarginal cell broader (La Jolla, Calif.) *gaudialis* Ckll

Smaller: flagellum red beneath; hair of thorax above white; stigma ferruginous; second submarginal cell narrower. (Las Cruces, N. M.) *prosopidis* Ckll.

5. Malar space a little longer than broad; mesothorax with much dark hair; abdomen comparatively narrow and parallel-sided *compacta* Cr

Malar space a little broader than long; mesothorax with little dark hair; abdomen broader; otherwise much like the last (Hanover, N. H.) *inæqualis* Say.

Like *compacta*, with the same transverse ridges on lower part of area of metathorax; but differing from *compacta* by its shorter malar space and shorter fourth antannal joint; differing from *inæqualis* by its narrower abdomen, smaller size, and much less yellow pubescence of thorax *skinneri* Viereck.

6. Basal (lower) margin of second submarginal cell about as long as basal margin of third: tegulae black. (Washington State) *kincaidii* Ckll

Basal (lower) margin of second submarginal cell much longer than that of third; tegulae light rufous. (New Mexico) . sp. incert. (placed in series of *consors*, but distinct from the type of that species).

7. Hair of face and thorax above all pure white, with no dark intermixed: malar space about twice as broad as long: flagellum all dark. *gypsicolens* Ckll.

Hair of face not white; or if so, that of thorax partly dark. . . . 8

8. Hair of thorax above decidedly yellow or fulvous (very pale ochraceous in *zonatus*) 9

Hair of thorax above greyish or whitish, or partly black 15

9. Hair of thorax with long fuscous hairs intermixed; abdomen strongly punctured; second submarginal cell very broad (Colorado) *simulans* Cr.

Hair of thorax without fuscous hairs intermixed; flagellum at most very faintly reddish beneath 10

10. Tegulæ light reddish, size small 11

Tegulæ dark 12

11. Hind tarsi dark like their tibiæ; abdomen less hairy (Illinois) *americana* Cr.

Hind tarsi red, their tibiæ red at base and apex; abdomen more hairy . . . . *annæ* Ckll.

12. Smaller; first abdominal segment with strong punctures; hair of face strongly yellowish; malar space extremely short (Georgia) *mandibularis* Smith.

Larger; first abdominal segment much more feebly punctured . . 13

13. First two abdominal segments extremely shiny, and not very hairy; punctures of scutellum extremely large (Georgia). . . *distincta* Cr.

First two abdominal segments not so shiny, and quite hairy . . . 14

14. Hair of thorax above fulvous; bands of abdomen ochraceous; second submarginal cell narrower, the recurrent nervure entering near end of first third. (Colorado.) . . . . *consors* Cr.

Hair of thorax above very pale; bands of abdomen white; second submarginal cell broader, the recurrent nervure entering a little basad of its middle . . . . *zonatus* Viereck.

15. Hair of thorax above without any, or any conspicuous admixture of dark hair; small species; stigma and nervures dark 16

Hair of thorax above with very conspicuous black hairs, that on the scutellum mainly or all dark 17

16. Base of metathorax more strongly sculptured, and with a transverse ridge; abdomen narrower; hind spurs light reddish . *spurcus* Viereck.

Base of metathorax less strongly sculptured, and without a transverse ridge; hind spurs dark . . . . *paniscus* Viereck.

17. Much larger; abdomen with extremely large and strong punctures *gilensis* Ckll.

Much smaller; abdomen with fine delicate punctures (Cuba) *submarginata* Cr.

Cœlioxys Latreille. (females).

Abdomen entirely red . . . . *abdominalis* Guér.

Abdomen with the first three segments red, the last three black *slossoni* Viereck.

Abdomen black, the first segment sometimes dark red 1

1. Middle of scutellum smooth, shining and impunctate (only partially so in *totonaca*, *uhleri* and *germana*) 2

Middle of scutellum densely punctured like the rest (with sparse punctures, or a small shiny space, in *totonaca*, *uhleri*, and *germana*) 11

2. Tegulæ dark 3

Tegulæ red 5

3. Abdomen not obviously banded; wings very dark fuliginous; apical dorsal segment subtruncate and strongly keeled. . . . *dolichos* Fox.
Abdomen obviously banded; wings not so dark, though apical half of anterior wings is fuliginous 4

4. Last ventral segment extending far beyond last dorsal; face with much white hair (Cuba) . . . . *uhleri* Cr.
Last ventral extending only a little beyond last dorsal; face without white hair (Cuba) . . . . *producta* Cr.

5. Thorax mainly red; last ventral segment extending far beyond the last dorsal; legs red; sides of abdomen largely red; clypeus deeply emarginate, its anterior margin like a broad W (Mexico) . . . *azteca* Cr.
Thorax not red 6

6. Last ventral segment extending very far beyond last dorsal; sides of first abdominal segment red; legs red 7
Last ventral segment extending only a moderate or short distance beyond last dorsal; or if rather far (*germana*), sides of first abdominal segment not red 8

7. Scutellar teeth short; median process of scutellum very broad and short (Mexico) . . . . *otomita* Cr.
Scutellar teeth very long; median process of scutellum long (Mexico) *tepaneca* Cr.

8. Scutellar teeth extremely short; pubescent markings of thorax above orange-fulvous (Jamaica) . . . . *foxii* Viereck
Scutellar teeth fairly or very long; legs red 9

9. Hair of sides of face yellowish; last ventral segment only slightly surpassing last dorsal; face between antennæ with a large elevated ridge (Mexico) . . . . *toltecea* Cr.
Hair of sides of face white; last ventral segment surpassing last dorsal by some distance; scutellar teeth long 10

10. Sides of first abdominal segment, and venter, red (Mexico) *totonaca* Cr.
Sides of first abdominal segment, and venter, only faintly stained with red (Illinois) . . . . *germana* Cr.

11. Tegulæ bright red 12
Tegulæ dark, black to dark reddish 21

12. Last ventral segment very broad 13
Last ventral segment rather or quite narrow 14

13. Last ventral segment fringed with short black hair, and without an apical projection (Dallas, Texas) . . . . *texana* Cr.

Last ventral segment not so fringed, and with a large apical projection (Kansas) . . . . *deplanata* Cr.

14. Last ventral segment with a strong fringe of black hair; first abdominal segment red; middle of scutellum with an impunctate line (Mexico) *chichimeca* Cr.

Last ventral segment not so fringed 15

15. Last ventral segment very narrow, not notched at sides (Mexico) *zapoteca* Cr.

Last ventral segment notched at sides, legs red (dark in *octodentata*) 16

16. Scutellum with a rather large median projection 17

Scutellum without any projection 18

17. Lateral teeth of scutellum slender (Illinois) . . . . . *germana* Cr.

Lateral teeth of scutellum broad (Mexico) . . . . . . *totonaca* Cr.

18. Last dorsal segment narrowed and strongly keeled apically, looking like a chicken's beak; size larger than *octodentata* or *altilis* (Texas) *insita* Cr.

Last dorsal not so 19

19. Larger; last dorsal long (Mexico) . . . . *mexicana* Cr.

Smaller; last dorsal shorter 20

20. Abdominal hair-bands white . . . . . . *octodentata* Say, Cresson

Abdominal hair-bands stained with yellowish . . . . . . *altilis* Cr.

(Robertson calls *octodentata* "Say" of Cresson, *C. sayi* rob., and regards *altilis* as the real *octodentata*. However, he admits that *sayi* was included in *octodentata* by Say.)

21. Last ventral ending in a very long spine, and with a very long fringe of black hair (Cuba) . . . . *uhlerii* Cr.

Last ventral not so ending 22

22. Last ventral broad, fringed with hair, and not notched at the sides 23

Last ventral notched at sides 24

23. Smaller; last ventral with a very small apical point or spine (Pa.) *modesta* Smith.

Larger; last ventral without such a point (Colorado) . *alternata* Say.

24. Last ventral very broad, abruptly narrowed, the apical process forming about an equilateral triangle; scutellum with a median tubercle (Colorado) . . . . *aperta* Cr.

Last ventral not so; sculellum without a median tubercle, last dorsal not curved upwards at end 25

25. Last dorsal, seen from above, abruptly narrowed 26

Last dorsal, seen from above, not abruptly narrowed 27

26. Part of last dorsal beyond the constriction much larger than wide (N. Y.) . . . . *dubitata* Smith.
Part of last dorsal beyond the constriction almost as wide as long (N.Y.) *comstockii* Cr.

27. Legs red (Cuba) . . . . *rufipes* Guér.
Legs black 28

28. Pubescence strongly tinged with yellow (Colchester, England) *acuminata* Nylander.
Pubescence white or faintly tinged with yellow. 29

29. Scutellar teeth moderately long; last dorsal rather short, but pointed (N. Y.) . . . . *quadridentata*, Linn. Cresson.
Scutellar teeth short; last dorsal longer 30

30. Larger; 13mm. long (N. Y.) . . . . *lucrosa* Cr
Smaller; hardly 12mm. long; abdomen more slender and more closely punctured (Connecticut) . . . . *moesta* Cr.

I take this opportunity to state that *Bombus medius* Cresson, supposed to have been collected by Suckley in Utah, is really Mexican. Prof. C. H. T. Townsend took it abundantly near San Rafael, on the Rio Nautla, State of Vera Cruz, March 8 to April 8, on six different species of flowers (his numbers 4, 15, 19, 23, 25 and 28), and I find specimens labelled "Mexico" both in the collection at Philadelphia and that at Washington.

TWO NEW MYMARIDÆ.

BY A. ARSÈNE GIRAULT, WASHINGTON, D. C.

Camptoptera metotarsa species novem.

Female. Length, 0.90 mm.

Shining black, the abdomen polished black. Legs, excepting the coxae and apical joint of tarsi, basal three-fourths of scape, and the venation, brown.

Head about as wide as the thorax, the eyes subovate, coarse, and very dark red; ocelli inconspicuous. Head and thorax coarsely shagreened, the latter short and convex, slightly longer than abdomen; parapsidal furrows absent. Abdomen depressed, short, oval. Legs long, the first tarsal joint long, the coxae rather large and coarsely shagreened, the posterior femur with a convexity or swelling in the middle of its upper margin. Wings iridescent, very slightly clouded, the fore wings narrow, curved, the marginal fringes rather long. Body nearly hairless.

Antennae elbowed, about as long as the body, 9-jointed. Scape very long, subclavate, narrowed basally, about as long, or not quite so, as the next three joints combined, or about five times the length of the pedicel. Pedicel short, very much smaller, obconic. Joints 3 and 4 slender, cylindric, 4 longer, about twice the length of the pedicel, both slenderer than the scape and pedicel; 5, 6, and 7 equal, columnar, stouter than 3 and 4, but much shorter, yet far longer than the pedicel. Joint 8 equal to 5, 6, and 7, but slightly stouter. Club cylindric, not as long as the scape, but much stouter, about equal in length to 6, 7, and 8 combined.

From a single female captured while jarring peach at Arlington, Virginia, June 2, 1905. A rather large and striking species.

Type.—No. 8941, United States National Museum.

Polynema picipes species novem.

Female. Length, 0.73 mm.

Whole body piceus black, shining; all of the legs excepting anterior coxae which are concolorous with body, basal portions of femora, and tips of the tarsi which are dusky, straw yellow. Oral area and tip of abdomen beneath pale yellowish. Femora darker than rest of the legs. Basal antennæ concolorous with legs; joints 3-6 darker; joints 7 and 8 brown; 9, or the club, piceus; the scape darker at extreme base. Eyes very dark; ocelli ruby red.

Head rounded, concaved along the face, wider than thorax; vertex roughened, front smooth. Thorax about equal to abdomen, narrow, polished, the parapsidal furrows deep and broad, the scutellum rounded posteriorly, and smooth. Postscutellum obtusely triangular, striate, separated from the scutellum by a semicircle of small foveae on the posterior margin of the latter. Abdomen regularly ovate (dorsal aspect), its tip abruptly pointed and acute, apical segment hairy at tip; polished. Segments 1 and 2 about equal, one-half longer than 3 and 4. Wings normal, iridescent, the marginal fringes moderately long. Venation pale yellowish. Petiole yellowish.

Antennae 9-jointed. Scape longer than pedicel, nearly as long as pedicel and first funicle joint combined. Pedicel cylindrical oval, not as long as joint 4; 3 much smaller, subequal to, or slightly larger than, 7 and 8; 4 long, cylindric, by far the longest funicle joint, shorter than scape, or slightly shorter than joints 5 and 6 combined. Joints 5 and 6 equal, oval, each much shorter than 4, much longer than 7 or 8; the latter equal or subequal to 3, or smaller. 9, or the club, conspicuously larger, elliptical.

Supposedly bred from the eggs of *Anthonomus quadrigibbus* Say in the fruit of *Crataegus*, sent in by Mr. J. H. Beattie from Fort Valley, Georgia, in connection with the Deciduous Fruit Insect Investigations, Bureau of Entomology, United States Department of Agriculture. The supposition is doubtful, the eggs of other insects evidently being present, as four distinct Mymarids and one species of Trichogrammidae appeared from time to time from the jars containing the infested fruit. These were species of *Gonatocerus*, *Polynema*, and *Ooctonus*, genera of Mymaridæ, and an undescribed Trichogrammid, near *Paracentrobia*. The hosts are therefore but obscurely indicated. Described from two females. June 20, 1905.

Type.—No. 8943, United States National Museum.

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDÆ.—LXII.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Leptomeris quinquelinearia Packard. This species occurred to me in the Platte Canyon, Colorado in July. Eggs obtained July 10 hatched in six days, the larvæ were matured on August 8 and the imagoes began to emerge on August 23. The weather was very warm. I met with the species again at Kaslo, British Columbia, obtaining eggs on June 17 which hatched in eight days. The larvæ grew very slowly, reaching the fourth stage in August and hibernated without becoming mature. The weather was cold and rainy all the season.

Egg. Laid loose, rolling about. Elliptical, one diameter less but not flattened, micropylar end truncated squarely and rather distinctly, the other end rounded. About 12 straight, parallel, longitudinal ribs, elevated, with a fine waved sharp crest, ending bluntly at the truncation, confused into reticulations at the other end. Cross-striæ fine, mostly parallel, a little raised, forming cells three times as wide as long. Micropylar end coarsely reticulate, a little bulging, the marginal reticulations joining the ribs which round over the edge of the truncation, being without bordering ridge. Uniformly whitish yellow, soon turning deep pink. Size .65 x .5 x .4 mm.

Stage I. Head rounded, free, erect, sordid testaceous. Body elongate, slender, normal, whitish, the dorsum broadly dark brown, diffusely narrowed at the anal end, obsoletely divaricate on joint 2; a similar broad subventral band staining the feet of joint 10; anal feet pale, thoracic feet partly brown. Tubercles and setæ obscure, the setæ short, narrowly club-shaped.

Stage II. Head rounded bilobed, erect, dull whitish spotted on the face, the vertex and sides thickly brown mottled; width .4 mm. Body slender, pale greenish, finely annulate. Dorsal and subventral bands of dark purple brown, the latter segmentarily submaculate in darker; traces of a white edge to the dorsal band and obscure line stigmatally.

Stage III. Head rounded, oblique, clypeus whitish, lobes more yellowish, brown dotted in the vertical suture and in a darker stripe over the center of lobe; width .6 mm. Body slender, finely annulate. Dorsal line dark brown, composed of a fine subdorsal line and a large dorsal one which widens segmentarily to be confluent with the subdorsals; rest dull green, slightly silky shining; a faint subventral brown shade joining brown segmentary spots. Thoracic feet brown, abdominal ones green, the foot of joint 10 brown before.

Stage IV. Head whitish, a straight line of dark mottling over the lobes and a short paler line each side of the vertical suture; width .9 mm. Body moderately slender, straight, the central segments three times as long as wide and finely, numerously annulate. Dorsum brown, undulating, cut by a dorsal line which is dark brown on the segments, yellowish in the incisures; a subdorsal black shaded line; sides and especially the subventral fold pale yellow; venter broadly black, pulverulent, cut by a broken subventral yellowish line. Feet pale, the abdominal ones pale outwardly. Marks all pulvurulent and shaded. General appearance dark brown with yellow line on subventral fold

Stage V. Head rounded, slightly bilobed, clypeus large, held obliquely flat, antennae large, projected; whitish on the clypeus, the vertex about the sutures brown, a nearly black mottled stripe over the center of the lobe, the space between yellowish white; sides white, sparsely brown mottled; width 1.2 mm. Body slender, normal, held straight, finely annulate; yellowish white, a broad diffuse, dorsal band, widened on the segments; narrow lateral, narrow stigmatal and narrow subventral brown-black lines, a broad segmentally widened ventral band sometimes pale or diluted medially. Lines pulverulent, not very definitely edged, more or less confluent. The subventral fold shows distinctly pale yellow. Some larvæ were light brown, others heavily black marked, others partly red-brown, partly black. Tubercles and setae small, obscure, spiracles black; thoracic feet pale, sordid, appressed; abdominal ones approximated, whitish outwardly dark brown within.

Pupation in a slight cocoon at the ground. The larvae were fed on *Polygonum*, their natural food plant not being determined, though I suppose they will feed on various low plants.

ON THE SECONDARY SEXUAL CHARACTERS OF NOTIOPHILUS.

BY ROLAND HAYWARD, MILTON, MASS.

Some years ago I published a short note on the secondary sexual characters of the North American species of Omophron (Psyche, ix, p. 304), in which I referred to the dilatation of the first* joint of the middle tarsi in the males of a large majority of our species of that genus. Until a short time ago I was unaware of the occurrence of this character elsewhere in the Carabinæ, though quite frequently observable in several groups of the sub-family Harpalinæ.

My attention, however, was recently called by Mr. E. A. Schwarz to the fact that C. G. Thomson (Bull. Soc. Ent. France, 1883, p cxii) had pointed out that in three European species of Notiophilus (*aquaticus* Linn, *palustris* Duft. and *biguttatus* Fab.) the first joint of the middle tarsi is dilated and spongy beneath in the males. I was thus led to an examination of the North American species. Males have been seen of all those known to occur within our faunal limits except *aquaticus* Linn. and *obscurus* Fall. Based upon this character they may be divided into two groups. Of these the first contains *aquaticus* Linn., *sylvaticus* Esch., *hardyi* Putz. and *nitens* Lec., in all of which the basal joint is dilated in the males, and, in the first three at least, spongy beneath. Whether the latter character occurs in *nitens* I have been unable to ascertain, as the only specimen that I have been able to study, i. e.: Leconte's type, is so mounted that only the upper surface of the joint is visible; but in all probability it agrees with the other species. Although not seen by myself, I have included *aquaticus* on Thomson's authority. In the second series the joint is simple as in the females Here are included *æneus* Hbst., *semiopacus* Esch., *semistriatus* Say and *sibiricus* Mots.

The tarsi are but narrowly dilated in the males of all our species. This applies to the anterior tarsi as well as to the basal joint of the middle pair.

M. Pierre Lesne (Bull. Soc. Ent. France, 1888, p. clxv) calls attention to a character common to many Carabidæ which he has observed in the European species of Notiophilus, i. e.: that the anal segment has one setigerous puncture each side at tip in the males, two in the females. This applies to all the species of our fauna that I have seen. Of *nitens* the male alone is known to me, in which the anal segment is unisetose each side. *Aquaticus* and *obscurus* are both unknown to me in nature.

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*Erroneously printed "second," but corrected ibid, p. 335.

A LIST OF THE SPECIES OF CATOCALA TAKEN AT GROTON AND WINCHENDON, MASSACHUSETTS.

BY WILLIAM N. SOUTHER, GROTON, MASS.

The following list of species of the genus _Catocala_, have been taken in the vicinity of Groton and Winchendon, Mass. Those marked with an asterisk have been collected in both places, while _Catocala minuta_ and _C. briseis_ have only been found at Winchendon.

Catocala *_nubilis_ Hbn., June 10, quite common.
*_amica_ Hbn., July 22, not common.
amica Hbn., var. _nerissa_ Hy. Edw., July 24, not common.
*_gracilis_ Edw., July 25, not common.
minuta Edw., August 1, rare.
*_grynea_ Cram., August 3, common.
crataegi Saund., var. _blandula_ Hulst, July 25, quite common.
*_ultronia_, Hbn., July 20, common.
coccinata Grt., July 24, not common.
*_cerogama_, Gn., August 19, not common.
*_ilia_ Cram., July 15, common.
*_ilia_ Cram., var. _uxor_ Gn., July 15, common.
ilia Cram., var. _zoe_ Behr. July 20, rare.
*_parta_, Gn., July 20, quite common.
*_unijuga_ Wlk., August 14, quite common.
briseis Edw., August 1, not common.
*_cara_ Gn., August 26, common.
*_concumbens_ Wlk., August 20, common.
*_amatrix_ Hbn., August 25, not common.
*_antinympha_ Hbn., August 2, common.
badia G. and R., July 24, rare.
*_habilis_ Grt., August 25, common.
*_paleogama_ Gn., August 14, common.
paleogama Gn. var. _phalanga_ Grt., July 20, rare.
*_neogama_ S. and A., August 20, rare.
*_piatrix_ Grt., September 1, quite common.
*_relicta_ Wlk., August 25, not common.
*_relicta_ Wlk., var. _phrynia_ Hy. Edw., August 8, rare.
*_relicta_ Wlk., var. _bianca_ Hy. Edw., August 28, rare.

epione Dru., July 26, common.
robinsonii Grt., August 18, rare.
retecta, Grt., August 20, common.
vidua, S. and A., August 25, common.
obscura Strck., July 7, August 18, rare.
**tristis* Edw., August 8, rare.

SOME NEW EUCERINE BEES FROM THE WEST.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

Melissodes herricki, n. sp.

♂ Length about 13½ mm., robust, black, densely covered above with short fulvous pubescence, very bright orange-fulvous on thorax; on abdomen thinner, showing the black shining surface through, but the hind margins of segments 2 to 6 broadly testaceous, and covered by fulvous hair-bands; face, cheeks, pleura and ventral surface generally with white hair; legs also with white hair, but the knee-tufts ochreous, hair on outer side of tibiae slightly yellowish, and that of inner side of tarsi pale orange; small joints of tarsi ferruginous; spurs ferruginous. Eyes large, greyish-brown; facial quadrangle much longer than broad; clypeus light lemon yellow, the anterior edge ferruginous; labrum cream-color, densely covered with white hair; mandibles entirely black; antennae of only moderate length (about 7mm), black; flagellum brown-black beneath, with obscure lighter dots on the joints; tegulae ochraceous; wings dusky hyaline, nervures dark fuscous; second submarginal cell broader than high, but by no means so long as first; second transverso-cubital nervure with a curious double curve; first r. n. joining second s. m. not far from its end; third s m. abruptly angled outwardly; apical plate of abdomen with the margins gently concave, not notched.

♀ Looks like the ♂, but abdomen rather broader, and appearing entirely fulvous, the pubescence being thick and the tegument yellowish; hair of apex very bright orange-fulvous; hair of legs more decidedly fulvous-tinged, that on outer side of middle tibiae shining light fulvous, that on inner side of basal joint of hind tarsi ferruginous; scopa of hind legs fulvous-tinted, long and beautifully plumose; facial quadrangle about square; clypeus and labrum black, the hair of the latter tinged with yellowish; apical half of mandibles mainly fulvous, antennae dark, third joint longer than 4 + 5, flagellum slightly brownish beneath. The double curve of the second t. c. is as in the ♂.

Hab.—New Mexico (*F. H. Snow*); no locality given, but the specimens are numbered 91 (♂) and 92 (♀). Named after the late Dr. C. L. Herrick, in recognition of his important work on the geology and zoology of New Mexico, carried on with indefatigable zeal for many years in spite of poor health and other difficulties. Superficially, this fine insect looks just like *M. townsendi* Ckll., but it is easily distinguished by the color of the antennae and of the hair of the scutellum. In the form and color of the abdomen the female *M. herricki* is like male *M. townsendi*.

Melissodes epicharina, n. sp.

♀ Length nearly 12 mm., rather stout, with a long-oval, convex abdomen; black head and thorax with abundant white pubescence, becoming mouse-color dorsally, with much black on vertex; mesothorax except in front, and scutellum; eyes dark grey-brown; facial quadrangle broader than long; clypeus strongly and extremely and densely punctured; labrum covered with white hair; mandibles entirely black; flagellum bright ferruginous beneath beyond second joint; mesothorax moderately shining, with distinct, not very close punctures; scutellum more closely punctured; tegulae piceous, with light hair, and a few black hairs intermixed; wings strongly dusky, with a reddish tint; nervures piceous; second s. m. broad but oblique, not narrowed above, receiving the first r. n. not far from its end; third s. m. narrowed rather more than half to marginal; legs black, small joints of middle tarsi, and hind tarsi, becoming ferruginous; hair of legs pale, ferruginous on inner side of tarsi, scopa of hind legs yellowish and strongly plumose; abdomen with light hair at base and sides, and long recumbent yellowish hairs on third and fourth segments, not abundant enough to alter the general dull black effect; on second segment is an even, rather broad, entire subapical band of cream-colored tomentum; two apical segments with black hair, tufts of white showing laterally; ventral segments fringed with pale hair, hair on last segment fuscous. The middle trochanters, and the adjacent base of their femora, have each a curious patch of ferruginous pubescence. Third joint of maxillary palpi long; fourth well-developed and cylindrical.

Hab.—Oak Creek Canyon, Arizona, 6000 ft., July (*F. H. Snow*). Very distinct by the one-banded abdomen, which gives it a curious superficial resemblance to *Epicharis maculata* Smith. A variety (Snow 443) has two bands, the additional one at the base of the second segment; in this example the eyes are sea-green. This may be called var. a.

Melissodes tenuitarsis, n. sp.

♂ Length about 9 mm.; black, shining, head and thorax with rather abundant, long, dull white hair, nowhere mixed with black, the disc of thorax nude; eyes light grey; facial quadrangle nearly square, but broader above than below; front bare, very black and shining; clypeus bright lemon-yellow, its anterior edge black; labrum black; mandibles black, the apical half reddened; antennae nearly 9 mm. long, entirely dark, the flagellum obscurely reddish beneath, without pale dots, the joints with more or less distinct longitudinal keels; mesothorax very shiny, with close well-defined punctures; at the posterior middle the punctures are sparse; scutellum similarly shiny and punctured, and with a little median longitudinal keel on its anterior half; tegulae piceous, with reddish margins; wings clear, almost milky, suffused with ferruginous towards the base; nervures ferruginous, second s. m. oblique, rather broader than high, receiving the first r. n. about the beginning of its last third; legs black, with scanty pale hair, claw-joints ferruginous; spurs yellowish-white; middle and hind tarsi very long and slender; basal joint of hind tarsi flattened but very narrow, not hairy; abdomen black, the hind margins of the segments very broadly whitish-hyaline; first segment with long dull white hair; the other segments with scanty pale hair, not forming definite bands, but apparently largely denuded; apical plate broad, deeply notched on each side; the usual four lateral spines; venter normal.

Hab. —Arizona (precise locality not given), Aug. 1902 (*F. H. Snow*, 1797). Very easily known from *M. confusa* Cr. and *M. microsticta* Ckll., by the slender tarsi.

Melissodes hexacantha, n. sp.

♂ Length about 11 mm.; black, rather robust; antennae comparatively short, hardly 7 mm. long; flagellum bright ferruginous beneath, except at base, but the apical margins of the joints narrowly darkened; third antennal joint more than twice as long as second; head and thorax with abundant light hair, whitish on face and beneath, pale ochreous dorsally, that on disc of scutellum and posterior disc of mesothorax black, but a band of ochreous between the black of mesothorax and scutellum; vertex with a very few black hairs at the sides; eyes pale greyish-green; facial quadrangle about square; clypeus strongly and extremely densely punctured, *black, with a yellow transverse band adjacent to the anterior margin*; labrum black; mandibles black, with a fulvous apical stripe; mesothorax shining, with strong rather close punctures; scutellum also strongly punctured; tegulae shining black, with light ochreous hair; wings slightly dusky, with a yellowish tint; nervures piceous; second s. m. very large, not narrowed above, but oblique, receiving the first r. n. not far from its end; third s. m. narrowed more than half to marginal; legs black, with yellowish-white hair; small joints of tarsi becoming ferruginous; spurs pale reddish; hair on inner side of tarsi pale dull orange; abdomen rather broad, with yellowish-white pubescence, forming subapical band on segments 2 to 4, but no defined basal one on 2; hind margins of segments broadly brownish-hyaline; pubescence of fifth and sixth segments chocolate-color; apical plate squarely notched at sides; last three segments spined laterally, the first pair of spines small, the second very large, the third slender.

Hab.—Arizona (precise locality not stated), Aug. 1902 (*F. H. Snow*, 447).

The antennae are very much shorter than in *M. tristis* Ckll. On account of the clypeal marking, this might be confused with *Xenoglossa pruinosa* and *X. angelica*, but it is very easily known from these by the black tegulae and black hair on scutellum

Three other specimens are numbered (Snow coll.) 2026 (Oak Creek Canyon, Ariz., 6000 ft. August), 2027 (also Oak Creek Canyon) and 1053 (Arizona); the last is much worn. These show that the species varies as follows:—

Var. a. Thorax above without black hair, except a very few (probably not half a dozen) on posterior middle of mesothorax, the dark hair remaining at sides of vertex, however. Hair of fifth and sixth abdominal segments black. No. 2026.

Var. b. Black hair very distinct on scutellum; lower half of clypeus yellow, with a pointed process of yellow directed upwards in the middle line. No. 2027.

Var. c. Yellow of clypeus reduced to a small stripe, about one-third as long as width of clypeus. No. 1053.

Melissodes nigrosignata, n. sp.

♀ Length about 12 to 13 mm; breadth of abdomen about 5 mm., or slightly over, a rather large robust species, having about about the size, build, and pattern of abdominal banding of *M. martini* Ckll., but the abdominal bands are creamy-tinted, and considerably broader; the pattern referred to consists of broad entire bands on segments 3 and 4, and 2 with an entire basal band, and a broadly interrupted median one, the lateral segments of the later pointed mesad, but not or hardly oblique. The basin of the first segment is covered with white tomentum (no dark intermixed), and the fifth and sixth segments are covered with black hair, long white hair showing at the extreme sides of the fifth; the hair of the venter is black, except quite at the sides, where it is white. Eyes reddish or grey; facial quadrangle a little broader than long: clypeus strongly and extremely densely punctured; mandibles with a brilliant orange apical stripe; antennae dark, flagellum faintly reddish beneath; hair of face, cheeks and pleura white, of head and thorax above pale ochreous; vertex with some black hairs, especially behind ocelli; hind part of mesothorax with a large patch of black hair, disc of scutellum also covered with black; tegulae black, with pale ochraceous hair; wings smoky, nervures black; second s. m. very large and broad, oblique, receiving the first r. n. near the beginning of its last third; third t. c. bent, not angled; legs black; hair of femora dull white; of anterior and middle tibiae dull white, with nearly half the outer side (divided obliquely) black, and the short hair on the inner side of anterior tibiae black; hair of anterior and middle tarsi black; of hind tibiae long (plumose on outer side) and stained with pale fulvous, some of the apical hairs on inner side tipped with black; basal joint of hind tarsi with long pale fulvous-tinged hair covering basal half outside, otherwise the hair is black, long, coarse and abundant on inner side. Third joint of maxillary palpi long.

Hab.—Oak Creek Canyon, Arizona, 6000 ft., Aug., 2 ♀. (*Snow*, 1988 and 1993.) Easily known for *M. martini* Ckll., by the color of the hair on the legs, the white hair showing at sides of fifth abdominal segments, and the narrower face. The black hair on thorax above, and other characters, separate it from *M. blakei*, Ckll. It really has a good deal of affinity with *M. glenwoodensis* Ckll., but is more robust, and is distinguished by the ochreous and black hair of thorax above, the hair on inner side of hind tibiae not black, their spurs longer, the hind one gently curved. It is conveniently distinguished from *M. mysops* Ckll., by the light hair of the pleura, and the bicolored middle tibiae.

Melissodes semitristis, n. sp.

♂ This is exactly what a hybrid between *M. tristis* and *M. menuacha* might be imagined to be like. It has precisely the stature, pubescence, etc. of *M. menuacha*, but the clypeus is wholly black (densely covered with white hair), the face is considerably broader, and the eyes are reddish-grey. The mandibles and labrum are black; there is no black hair on the disk of the thorax. From *M. tristis* it differs in having the stature of *menuacha*, and the nervures piceous or very dark brown; the width of the face agrees with *tristis*. Tegulae black, as in *tristis*. The insect is to *tristis* much as *menuacha* is to *agilis*.

Hab.—Oak Creek Canyon, Arizona, 6000 ft., July. (*F. H. Snow*, 2009.)

Melissodes prælauta, n. sp.

♂. This looks just like *M. semitristis*, and was placed with it until the very different head was observed. The eyes are black and very prominent, and the face is narrowed below, so that the length of the facial quadrangle is considerably greater than its breadth at the lowest point; the face is very densely covered with long pure white hair, and the clypeus is of a curious greyish-white color; the mandibles are entirely black, except a small yellowish apical stripe; the labrum is black, with a large yellowish-white spot. The maxillary palpi are normal for *Melissodes*, with the last joint minute. The antennae are about 7mm. long, or rather more, with a rather stout flagellum, which is dark chestnut-red beneath. Tegulae black; nervures rufo-fuscous, wings perfectly hyaline, rather milky; *second s. m. extremely large, larger than first*, broader than high, receiving the first r. n. near the beginning of its last third; no black hair on head or thorax; the abundant hair of head, pleura and mesothorax entirely snow-white; that of metathorax, scutellum and abdomen more or less strongly stained with yellowish, that of the apical part of the abdomen quite ochreous; ocelli ruby-color; mesothorax shining and punctured; hind margins of abdominal segments broadly yellowish-hyaline, the hair-bands apical and only moderately conspicuous, the region between the bands being more or less hairy; *the last three segments with prominent lateral teeth*; legs black with white hair, only the claw-joints rufous; hair on inner side of basal joints of middle and hind tarsi clear ferruginous. The abdomen is not quite so broad as that of *M. semitristis*.

Hab. Oak Creek Canyon, Arizona, 6000 ft. (*F. H. Snow*, 2010). The peculiar appearance of the clypeus suggests that it may have failed to attain its natural color, but assuming this part to be naturally yellow; it is still impossible to identify the species with anything previously described. Seen from behind, the insect could very well be taken for *M. menuacha*, but in front the much darker antennae, narrower face, dark eyes and white pubescence are distinctive enough. *M. Snowi* Cr., which has the white pubescence in front, has it also behind, besides being much smaller.

Melissodes duplocincta, n. sp.

A species with a narrow abdomen and bluish-white pubescence, having a remarkable superficial resemblance to *Synhalonia lippiae* (Ckll.), but the subapical band on second abdominal segment, which in *lippiae* is reduced to a line on each side, is in *duplocincta* entire and even, so that the anterior part of the abdomen is girt by by two parallel clean-cut white bands, separated by a black interval about as wide as either of them. The third and fourth segments in the female, and the third to fifth in the male, have broad even white bands. The pubescence of the head, thorax and legs is white, but the disc of the scutellum is covered with short black hair, and some greyish-brown hair is mixed with the white on the mesothorax, producing in the ♀ a curious streaked or mottled appearance, as though the hair were stained; the hair of the vertex is entirely white in the ♂, but there are dusky hairs just behind the ocelli in the ♀.

♂ Length about 10 mm.; antennae long, about 7½ mm.; scape stout; flagellum slender, clear ferruginous beneath, except the apical two or three joints, which have not the form of *Synhalonia*; clypeus lemon-yellow, with a large squarish black mark at each side above; labrum pale yellow; base of mandibles entirely yellow; tegulae light fulvous; wings clear, stigma ferruginous, nervures fuscous; second s. m. almost exactly square, receiving the first r. n. almost at its end; third s. m. narrowed not quite half to marginal, its outer side curved, not angled; legs black, tarsi rather dark ferruginous; a raised, curved, transverse lamina on each side of venter near apex; spines at sides of sixth segment black, and unusually long; first segment of abdomen with much white hair, but the broad apical margin bare except at the extreme sides; other segments as described above; sixth covered with black hair, with a few light hairs at sides.

♀ Similar to the male, eyes pale greenish-grey; no yellow on clypeus, etc., the clypeus shining, with small punctures and little ridges, a sort of strawberry surface; middle of mandibles reddened; flagellum red beneath except basal joint; base of third abdominal segment broadly dark dull reddish, the two apical segments with black hair, a good deal of white at extreme sides of fifth; venter reddened basally; scopa on hind legs glistening white.

Hab.—Bill Williams' Fork, Arizona, August (*F. H. Snow*), one of each sex. *M. duplocincta* runs in my tables (♀) to the vicinity of *M. pecosella*, to which it is allied, but from which it is easily known by the narrower, bluish white (not creamy) abdominal bands, and the light reddish tegulae The width of the face is about the same. From *M. intermediella* it is separated by the shape of the abdomen, the whiter and more even abdominal bands; the square (not oblique) second s. m., with the first r. n. joining nearer the end; and the light reddish, tegulae (they are very dark in *intermediella*). The clypeus also is very shiny, whereas in *intermediella* it is very densely punctured and dullish. The male *duplocincta* runs to the vicinity of *M. paroselæ*, Ckll.; but the latter is smaller, with the hair of the thorax in front light fulvous, the tarsi clearer red, etc.

Xenoglossa strenua, Cr, var. *Kansensis*, n. var.

♂ Rather larger; legs dark reddish-fuscous, the anterior legs at most ferruginous but then dull-colored, very different from the typical bright red; tomentum of apical abdominal segments pale cinereous or whitish, not at all ochreous or fulvous.

Hab.—Clark Co., Kansas, 1962 ft., June (*F. H. Snow*, 1186); Morton Co., Kansas, 3200 ft., June 1902 (*F. H. Snow*, 439); Wallace Co., Kansas, 3000 ft. (*F. H. Snow*, 1791.)

THE TUSSOCK MOTH IN ROCHESTER, N. Y.

Because of the destruction which has been wrought on shade trees by the tussock moth, the Board of Park Commissioners has declared war against the pest and the school children of the city are now enlisting in a war of extermination on the cocoons. The crusade is being conducted on the lines followed in the famous hunt of eleven years ago, when Rochester was so thoroughly cleaned of cocoons that not until the present year have the ravages of the past become serious again. The school children will be paid seven cents a quart for the cocoons, each quart to contain about 400 egg masses and weigh 2½ ounces. Five hundred dollars has been appropriated by the park board for the purpose. In addition to the regular payments, there will be six special prizes of $5 each to the six boys making the highest records. It is an interesting calculation to figure how many caterpillars will be destroyed by this plan if the fund be exhausted. At seven cents a quart $470 will buy 6714 quarts of egg masses. Each quart must contain at least 375 egg masses, or a total of 2,517,750 egg masses in the 6714 quarts. Professor Slingerland of Cornell University estimated that each egg mass would produce 200 caterpillars, so that 2,517,740 egg masses would produce 503,550,000 caterpillars next spring. Approximately, therefore, 500,000,000 caterpillars will be destroyed by the expenditure of the $500, which is at the rate of $1 a million, or 10,000 caterpillars for a cent. In the cocoon hunt of eleven years ago the first prize was won by a boy who was credited with collecting more than 2,000,000 cocoons, and his nearest competitor had more than 1,500,000 to his credit. It was estimated that the pupils of one school alone had destroyed 7,500,000,000 caterpillars. No one else had figured out how many caterpillars were killed by the work of all the schools, but it was sufficient to keep the city clear of the pest for more than a decade. In view of these facts members of the park board do not agree with the State entomologist at Albany, who in a recent bulletin belittles the value of such a crusade. (*Boston Evening Transcript.*)

RECENT ENTOMOLOGICAL LITERATURE.

MAY FLIES AND MIDGES OF NEW YORK. BULLETIN 86, NEW YORK STATE MUSEUM.

This interesting and important work, which constitutes the third report on the aquatic insects of New York State, contains 352 pages and 37 plates. Professor James G. Needham gives an interesting account on the summer food of the bullfrog, followed by systematic notes on the Hemerobiidae and the Ephemeridae, with keys to the genera and descriptions of six new species and one new genus *Drunella*. The family Hydroptilidae is treated by Mr. Kenneth J. Morton; one new genus (*Neotrichia*) and twelve new species being described.

The greater portion of the report is by Mr. O. A. Johannsen on the Nematocerous Diptera comprising the family Chironomidae. This is the first American publication of a monographic character bearing on this large and important family, and the degree of thoroughness with which the author has accomplished this work calls for great praise. The Chironomid genera of the world are defined, and all the North American species tabulated and described, together with many of the larvae and pupae, except the group *Ceratopogon* which is only generically treated.

Some idea of the amount of work involved can be gained from the following figures: upwards of 50 genera and over 200 species are described, including two new genera (*Anatopynia* and *Ablabesmyia*) and 58 new species, or species that are not recorded in Aldrich's Catalogue. The genus *Tanypus* of authors is divided into three genera, *Procladius*, *Ablabesmyia* and *Tanypus*. The group *Ceratopogon* now comprises the genera *Ceratopogon*, *Culicoides*, *Oecacta*, *Bezzia*, *Ceratolophus* and *Palpomyia*, the latter being divided into a number of subgenera including *Heteromyia* Say.

C. W. J.

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Asterisks indicate descriptions of new species of American insects or of new genera.

PERIODICALS CITED.

4 The Canadian Entomologist, London, Ont.
6 Journal of the New York Entomological Society.
7 U. S. Dept. Agriculture, Bureau of Entomology. Bulletins and Circulars.
8 The Entomologist's Monthly Magazine, London.
11 The Annals and Magazine of Natural History, London.

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38 Wiener Entomologischer Zeitung.
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189 Memorias do Museu Goeldi (Museu Paraense). Para.

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In accordance with the vote of the Club, PSYCHE will henceforth give as much space as possible to papers presenting the results of experimental work in entomology. With a view to making the journal more efficient in this direction, three new associate members have been elected: Professor Charles B. Davenport of the Carnegie Institution, Professor Vernon L. Kellogg of Leland Stanford Junior University, and Professor James G. Needham of Lake Forest University. All these have accepted, and their names appear in the list this month.

MEETINGS OF THE CLUB.

A regular meeting of the Club is held on the third Tuesday of each month (except July and August) in the room of the Appalachian Mountain Club, 1050 Tremont Building, Boston. Meetings begin at 7.45 P. M. Entomologists visiting Boston are cordially invited to be present.

PSYCHE

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EXCHANGES.

[Exchange notices (not over five lines) inserted free for subscribers. Notices will be inserted in the order in which they are received, and those at the top of the column will be removed only when it is necessary to make room for new ones at the bottom.]

AMARA. Being engaged in the study of this genus, I will determine specimens for collectors. These should be sent numbered. I am also anxious to obtain species in other genera of Carabidae not in my collection, from all parts of the world, and will purchase or exchange for same. Roland Hayward, Readville, Mass.

WANTED—Eggs, larvae or pupae of grasshoppers, dragon-flies, beetles, bugs, etc. Will give tropical butterflies in exchange. Denton Bros., Wellesley, Mass.

WANTED—Material for the study of the hybrid or polymorphic butterflies of the genus *Basilarchia*, including larvae or pupae of *arthemis* or *astyanax*, imagos of *proserpina* or *arthechippus* or any specimens showing unusual characters. Liberal exchange. Specimens retained will be deposited in Museum of Comparative Zoology. W. L. W. Field, Milton, Mass.

LEPIDOPTERA—For exchange, fertile eggs of *Hemileuca maia*. Alfred C. Sampson, Sharon, Mass.

I have a few specimens of *C. calleta* and *cinctus* to exchange for rare *Sphingidae* or Pupae of same. W. T. Buxton, 17 Walter St., Somerville, Mass.

WANTED—Ova, larvae or pupae of *Limenitis ursula* and *arthemis*. Will give cash or exchange. H. H. Newcomb, 35 Court St., Boston, Mass.

Will collect Diptera, Hymenoptera, Hemiptera and Coleoptera. Would like in exchange, quantities of named or unnamed Buprestidae, Scarabaeidae, Cerambycidae and Chrysomelidae. Please write immediately to G. Chagnon, P. O. Box 186, Montreal, Canada.

Correspondence desired regarding Rhopalocera of North and South America, especially Argynnis, Papilio, Morpho, Caligo. Exchange or otherwise. T. H. Shepherd, 15 Hope View, Carr Lane, Shipley, Yorks., England.

EASTERN MASS. MOTHS WANTED in exchange for same. Also, reliable colored sketches of larvæ of same. C. V. Blackburn, 101 Pine St., Woburn, Mass.

Am willing to make contracts to collect for the season, with private collectors, museums colleges, or any public institution for insects of any order or group desired, either in large or small series. Duplicates of all orders for sale from Colorado, New Mexico, and Arizona. Correspondence solicited. Ernest J. Oslar, 4535 Raleigh St. Alcott P. O., Denver, Colorado.

WANTED—Records of captures of Connecticut insects—especially the rarer species—for the preparation of a State list. Orthoptera and Hymenoptera records desired at once. W. E. Britton, State Entomologist, New Haven, Conn.

CICINDELIDAE of the world wanted. Good exchange in all families of Coleoptera offered. H. F. Wickham, Iowa City, Iowa, U. S. A.

PSYCHE

ANTS FROM THE SUMMIT OF MOUNT WASHINGTON.

BY WILLIAM MORTON WHEELER, NEW YORK, N. Y.

During the past year Mrs. Annie Trumbull Slosson spent several months on the summit of Mount Washington, N. H., collecting and studying the insects. She has kindly sent me all the species of ants she succeeded in taking. Though the collection is a small one, as this group of insects was very poorly represented on the summit, it is nevertheless of more than usual interest. It comprises the following forms:

1. *Camponotus herculeanus ligniperdus* Latreille var. *pictus* Forel. A single deälated female. My collection contains two very similar specimens taken during August 1901 in the same locality by Dr. C. S. Bacon.

2. *Formica sanguinea aserva* Forel. Two deälated females. I have recently found two colonies of this form in the Litchfield Hills, Conn., at an altitude of about 1000 ft. The females are rather small (7-8 mm.) compared with those of our more abundant *F. sanguinea rubicunda*. The gaster and head are black, the thorax and petiole dull yellowish brown, the former mottled with black, the legs and antennae dark brown. The rich red color of our common forms of *sanguinea* is completely lacking. The clypeal notch is broad and deep.

3. *Lasius niger* L. var. *americanus* Emery. A single winged female of very small size (5.3 mm.) but in other respects like the common form.

4. *Lasius umbratus mixtus* Nylander var. Three males and two winged females resembling the corresponding sexes of var. *aphidicola* Walsh, except that the females collected by Mrs. Slosson are decidedly darker.

5. *Dolichoderus taschenbergi* Mayr var. *gagates* Wheeler. A single deälated specimen of the hitherto unknown female of this species and variety. It measures 4 mm. and resembles the worker in the structure of the epinotum. The head and thorax are very smooth and shining, the epinotum somewhat more opaque, with scattered shallow foveolæ. The body and appendages are deep black, the tips of the mandibles and articulations of the legs slightly brownish.

6. *Leptothorax acervorum canadensis* Provancher. Three deälated females all darker than the females of the typical form in my collection.

7. *Myrmica rubra brevinodis* Emery var. A single winged female differing

from the typical form in being of smaller size and much darker color and in having the antennal scape somewhat straighter at the base.

8. *Myrmica rubra scabrinodis* Nylander var. A single deälated female belonging to a form of this subspecies with a small calyculate dilatation at the base of the antennal scape, long straight epinotal spines and strong sculpturing on the head, thorax and pedicel.

✓ 9. *Myrmica rubra scabrinodis* Nylander var. *schencki* Emery. A single winged female taken by Dr. C. S. Bacon during August 1901 on the summit. This insect is darker in color than females from Colebrook, Conn., in my collection.

This little collection of ants is remarkable because it comprises males and females but no workers. This fact taken in connection with Mrs. Slosson's statement to me that she was quite unable to find any colonies of ants on the summit, but at most chance aggregates of two or three females, indicates that this portion of the mountain, which is above timber-line, must be peopled anew every year by female ants that never succeed in establishing colonies. These females (and the shorter-lived males, when these are found, as in the case of *Lasius nixtus* above recorded) undoubtedly drift to the summit while on their nuptial flight. This is shown by the relatively large number of winged females in the above list. They are in all probability individuals that have ascended to an unusual altitude and have been swept onto the mountain summit by an upper air current. This seems to be the only way of accounting for the peculiar occurrence of forms like *Dolichoderus gagates* in such a locality. This ant is not known to breed further north than the low pine-barrens of New Jersey, where it nests in the warm, white sand about clumps of grass and attends plant-lice on the pines and scrub oaks.* The occurrence of this insect on a mountain summit 6293 ft. high and some hundreds of miles further north must be regarded as accidental. Only in case the *Dolichoderus* females succeeded in establishing their colonies on the summit of Mt. Washington would this condition be truly analogous to that of certain plants like the eastern prickly pear (*Opuntia opuntia*) which grows in low sandy spots in Florida and on the rocky ledges of certain hilltops in New Jersey, New York and Massachusetts. A strictly parallel instance, however, seems to be presented by *Tapinoma pruinosum* Roger, an ant which I have taken in the sandy pine-barrens of New Jersey and on the summits of some of the Ramapo Mountains in southern New York, but not in intermediate stations.

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*Conf. my paper: The North American ants of the Genus Dolichoderus, Bull. Am. Mus. Nat. Hist. Vol. XXI, 1905. pp. 305—319.

In the study of mountain faunas it is well to bear in mind what Forel says in his work on the ants of Switzerland*: "One should never judge of the habitat of a species from the elevations at which isolated males or females have been captured. We have, in fact, observed that these sexes always seek the summits for the purpose of mating. On a beautiful day in summer, they often alight in regions where their species cannot subsist, and where they soon perish. Thus M. Bugnion found males of *Formica rufa* and *pratensis* on the Hüfi Glacier and he brought me specimens of these ants from the summit of the Stätzerhorn (Grisons). I have myself taken males and females of these ants on the snow-covered ridge which separates the Engadine from the valley of Roseg between the Piz Surlei and the Piz Corwatsch. Now neither the formicaries of *rufa* nor the formicaries of *pratensis* are found above the region of pines, whereas the winged individuals just mentioned had ascended to that of the eternal snows. Hence a female *Myrmecina Latreillei* which I took at a considerable elevation in the Jura near Mont Tendre does not prove to me that the formicaries of this species subsist at such an altitude."

The absence of ant colonies on the summit of Mount Washington is to be attributed to the length and rigor of the winter at such an elevation. In the Rocky Mountains colonies are very abundant up to an altitude of 9000 to 10,000 ft. and may be found even as high as timber-line between 11,000 and 12,000 ft. I have observed this distribution on Pike's Peak, near Cripple Creek, and on the neighboring mountains. Very similar conditions seem to prevail in the Himalayas.

Bare, cold mountain tops thus appear to be a source of "catastrophic elimination" to those winged seeds of their species, the female ants. Other sources of such elimination are torrential showers occurring during or just after the marriage flight; many birds, which are fond of eating winged ants; and drowning, as the result of long flights out to sea or over our Great Lakes. During the summer months the insect drift which is cast up on the beaches of Lake Michigan and Lake Superior sometimes contains thousands of dead female ants. Other less important agents of destruction are some of the solitary wasps that provision their nests with female ants captured during or just after the marriage flight. *Aphilanthops frigidus*, for example, has been seen to capture and carry home our common *Formica fusca* var. *subsericea*. Mr. H. L. Viereck has sent me specimens of these wasps collected together with their prey by Mr. Morgan Hebard in Baraga County, Michigan. When we add to these destructive agencies the attacks of lethal fungi and subterranean insects on the females after they have shut themselves off from the world in their earthern cells for the purpose of ovipositing and rearing their brood, we are able to understand why so very few of the myriads of female ants that annually take their nuptial flight, ever survive to become the mothers of flourishing colonies.

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*Les Fourmis de la Suisse, Zürich 1874, p. 211.

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE—LXIII.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Sciagraphia neptata Guenée.

Egg. Elliptical, very strongly flattened, concave, slightly wedge-shaped in side view, the ends rounded; evenly reticulate in broad, rounded ridges, wavy, stellate hexagonal, rather smaller on the flat sides. Dark bluish green, turning red around the margin. Size .8 x .5 x .3 mm.

Stage I. Head rounded, brownish luteous, sutures darker. Body moderate, rather short, luteous, dark olive green shaded broadly over the dorsum except on joints 2 and 13 posteriorly: venter faintly dark shaded. No shields; tubercles and setae obscure, tubercles slightly elevated, but concolorous, setae stout, pale, quite small, enlarged at tip.

Stage II. Head luteous, slightly bilobed; width .5 mm. Body moderate grayish green with broad ventral purple brown stripe and faint, narrow, pale lines, two showing in the subdorsal region. Feet dark within; tubercles and setae obsolete.

Stage III. Head round, full, flattish before, greenish white with a straight brown mottling on the sides; width .9 mm. Body moderate, green, the dorsum with five parallel olivaceous blackish bands as wide as the interspaces; venter broadly smoky blackish. No shields; thoracic feet shaded darker; abdominal ones pale without; tubercles minute, setae fine, dark.

Stage IV. Head bilobed, oblique, pale greenish luteous with whitish shades, a brown flush on the sides, the angle below the eyes and antennae whitish; width 1.5 mm. Body uniform, rather flattened, anal feet large; obscure whitish, not strongly green, a broad subdorsal geminate band more whitish; stigmatal fold pale yellow; a ventral vinous brown shade staining the bases of the feet. Tubercles obsolete, setae fine, dark, obscure. A subventral dark spot on joint 6.

Stage V. Head bilobed, thicker at apex, pale brown shaded, a curved dark brown band across above clypeus and a yellow one on the side behind the eyes; width 2.2 mm. Body moderate, uniform, a somewhat raised black patch subventrally on joint 6. All yellow brown shaded; dorsal, subdorsal, lateral, subventral geminate blackish lines, broken, powdery, the dorsal appearing as intersegmental spots, the others broken intersegmentally, giving an effect of obscure segmentary transverse bands on central part of body. Dark blotches at the bases of the thoracic feet, especially on joint 4; tubercles small, dark, setae dusky.

rather long, fine; feet pale; spiracles black edged.

The larvae fed on the balsam poplar (*Populus baslamea*); eggs from Kaslo, British Columbia July 27, mature larva in September. The species is double brooded with hibernation in the pupal stage.

THE BEDBUG, *CLINOCORIS LECTULARIUS*[a] (LINNAEUS), AND THE FOWL BUG, *CLINOCORIS COLUMBARIUS* (JENYNS): HOST RELATIONS.

Adults and larvae attack dead and living mice (*Mus*); *columbarius* feeds on human blood.

BY ALEC. ARSÈNE GIRAULT AND JOHN FRANK STRAUSS, WASHINGTON, D. C.

I. *Clinocoris lectularius* (Linnaeus).

In experimental medicine, the host relations of our common bedbug are of importance from the fact that if they attack animals other than man, their scope in the potential transmission of diseases becomes greatly enlarged. In reviewing the entire entomological and medical literature, as far as it concerns the bedbug, the writers have been unable to come to any definite conclusion concerning these host relations. As far as the entomological literature is concerned, no conclusions at all are possible, for the simple reason that authorities differ, and that no definite experiments have been cited to show that the host of the bedbug is other than man himself. In fact, most of the statements to the contrary are purely conjectural or theoretical.

In the literature of experimental medicine, however, it has been quite frequently stated that bedbugs attack mice, living and dead, and these mice were so used in the experiments performed. But the statements of these facts have been so general, and in a way, so unscientific, that the writers could not, in strict justice, come to any other conclusion than that it was very probable that *lectularius* attacked animals other than man. Nuttall (1897, 1898), in his most important experiments on the transmission of diseases by the bedbug, however, nearly convinces us that both living and dead mice are readily attacked by *lectularius*, but doubt could not be eliminated, because of the use of the general term *wanzen* instead of a specific name, and on account of the presence of a single ambiguous sentence (Nuttall, 1898, p. 626, footnote).

Correspondence with some of the leading hemipterists and personal communications from economic entomologists, all tend to throw doubt on the statements thus made in the medical literature. Scepticism coming from such sources cannot be better evidence, and practically shows that the question remains as yet unsettled.

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[a] *Clinocoris* is masculine, not feminine, as would be inferred from its ending. (Kirkaldy.)

In view of the foregoing facts, and because of the importance of the question, the following preliminary and rather crude experiments have been performed, showing that *lectularius* will readily attack both living and dead mice. The experiments also explain to a certain extent, the supposed occurrence of the bedbug in long unoccupied houses, from the fact that writers, now, will not have to theorize in regard to moisture, and so forth as a food, in order to support their statements.

The specimens used in these experiments were all obtained by jarring beds in one of the large mission houses in the city of Washington, about 7 P. M., September the eleventh, 1905. They were then full-fed, and the majority of them in the last larval instar (instar V). They soon molted, and then, were specifically determined by comparison with specimens in the collection of the United States National Museum.

A. *Experiment with a recently dead mouse.*

A single mouse killed in the insectary of the Department of Agriculture at 8.40 A. M., September 20th, was immediately placed under a large bell-jar, on a clean sheet of white paper.

1. *Nymph.* Six minutes afterwards, 8.46 A. M., a nymph in instar III, which was starved when captured on September 11th, was placed under the bell-jar. It was nearly transparent. The larva paused a few seconds, and then went to the carcass; at 8:46:35 A. M., it was feeding from the toes of the left hind leg, from which it was apparently unable to extract much blood. At 8.51 a. m., it left the toes and crawled completely around the head end of the body to the right hind leg, and there again attempted to feed from the toes of that leg, but with little or no success. At 8:53:30 A. M., it left its last position, crawled around the head end of the body, and attached itself to the abdomen. Up to this moment, the larva was but slightly tinged with blood. Attached to abdomen at 8:54 A. M.; larva's abdomen red from blood at 8:54:30 A. M.; larva half full of blood at 8:57 A. M. The larva appeared to be weak, and was having much trouble to obtain blood. After 9 A. M., the larva remained the same, as far as the amount of food obtained is concerned, but frequently changed its position on the carcass. It was removed from the carcass at 10:30 A. M., having voluntarily left it at 10:20. The body of the mouse was getting cold at 9:08 A. M. The larva was not fully gorged with blood, but it is evident that this was due to its weakness, a condition apparently due to its age, combined with its previously starved condition. Cases of this kind are often met with in this species. It molted on September 28th, without having been fed again.

2. *Adult.* An adult, not recently fed when captured on September 11th, was placed under the bell-jar at 9:26 A. M. The body of the mouse was then cold, and a little stiff.

The adult wandered about, and then at 9:27:30, crawled under the carcass; body then flat and fully colored. Hiding from light. In a few minutes, crawls from beneath the carcass to the side of the bell jar, not having fed. Jar covered with a black cloth

At 9:44 A. M., jar uncovered and the adult found fully gorged with the blood from the carcass. It was found at rest on the back of the mouse, but began to wander on exposure to the light. Body of mouse now stiff and cold. Adult removed.

Another hungry adult placed under the bell-jar at 11 A. M., the mouse then being dead 2 hours and 20 minutes. It was pale, having just recently passed the fifth ecdysis. At once hid under the carcass.

It did not feed up to 3 P. M., and was then removed. The blood in the carcass had by that time coagulated. Experiments discontinued on account of the lack of material.

B. *Experiment with a living mouse.*

A mouse trapped in the insectary of the Department of Agiculture during the night of September 21–22, 1905, was confined under a bell-jar as in the first experiment at 9 A. M., September 22nd.

At 9:40 A. M., three adults, captured when full-fed in instar V, on September 11th, and since molting on September the 18th, and a single larva in instar IV, hungry when captured, were placed under the jar and the latter covered with a black cloth to exclude the light. None of the insects had fed up to 6 P. M.

At 7 A. M., September the 23rd, the day following, the cloth was removed from the jar, and all of the insects found fully gorged with blood, the abdomens of the adults immensely swollen. Upon exposure to the light they as usual wandered quickly about. The experiment was not repeated because of the lack of enough suitable material,—hungry bedbugs.

C. *Experiment with recently born mice.*

At 6.30 P. M., September 28th, three recently born mice were placed in a group on a clean sheet of white paper and covered with a small bell-jar. Although much alive, their bodies were cold.

Immediately afterwards, three adults of *lectularius*, full-fed nymphs in instar V when obtained on September 11th, molting on September 19th, and now, therefore, hungry adults, were introduced. Left over night in a dark room.

At 7 A. M., September 29th, adults found greatly swollen with blood from the mice. The latter still alive.

These experiments show clearly enough that *lectularius* will readily feed on mice, at least under the conditions in foregoing. It has now to be proven whether or not they can breed under such conditions. There appears to be no reason why they cannot, yet experiments are necessary to prove that they can. The writers have been unable to experiment in this direction because of the difficulty experienced in obtaining either eggs from confined adults, or very young nymphs from other sources.

It is hardly necessary to say that more experiments are needed on all points in the question involved.

II. *Clinocoris columbarius* (Jenyns).

As with *lectularius*, so with this species. The host relations are entirely unknown. That is, the statements concerning these relations are so confusing, that no positive conclusions are possible. The following preliminary experiments may help to a better understanding of them.

Thirty-two specimens, in all stages, were obtained on September 24th, 1905, from a chicken house, in a large fowl yard at Anacostia, D. C. The house in which they were found was a barn-like structure, consisting of an elevated first floor and a loft above. On the former, which consisted of a main hallway running the entire length of the building, and of pen-like rooms of rather large dimensions, on each side, made of closely fitting laths coated with whitewash, was occupied entirely by chickens. Each room contained about three nests, made of boxes filled with straw. The loft above was occupied by pigeons.

The first floor of the structure was reached from the ground by means of a stairway. The building itself was surrounded by quite extensive yards, all alive with different kinds of poultry and pigeons, and was not very distant from the dwelling of the superintendent.

The bugs were not easily found at first. In fact, none were found in the nests. The first sign of their presence was found in the spider nests along the walls, which sometimes held large masses of dead bugs and exuviae; generally, however, but one or two. Finally, the insects were found hiding in cracks between the laths, or in dark corners of the room; in such places, eggs were quite frequently found. Nearly all of them were full-fed, showing a constant supply of food at hand. They were in all stages, and it was quite difficult to dislodge them. The attendant, who was following, said that no bugs were present. But a casual observer would hardly have noticed their presence.

It struck the writers at once, that an excellent opportunity here offered to prove whether or not this species would naturally leave their preferred hosts, chickens, and go to the dwellings of man; or whether they would crawl onto man, thus be transferred to his dwellings, and breed there. But this could not be determined because of the absence of the superintendent, and nothing could be obtained from the attendant, who denied all knowledge of bugs, especially those found in beds.

This species found associated with chickens agrees well with the description of *columbarius* given by Osborn (1896), and they agree with supposed specimens of that species now in the collection of the United States National Museum. On comparison with other species in the National Museum collection, they are at once easily separated from the species associated with the bat (*pipistrelli* Jenyns), and with the swallow (*hirundinis* Jenyns). They are closer to *lectularius*, but differ in the shape of the body, which has the greatest width of the abdomen at the middle, and which, in general, is smaller, and in the relative lengths of joints 3 and 4 of the antennae, which are subequal in *columbarius*, but joint 3 much longer than 4 in *lectularius*. They cannot possibly be *Acanthia inordora* Dugès. The specimens in the National Museum are from the United States.

A. *Experiment with human blood.*

At 6.45 P. M., September 28th, an adult of this species, full-fed when captured, was placed into a small glass vial and the latter then inverted over a portion of the fore arm, just above the wrist. In this way, the insect was forced to rest on a portion of the skin.

Upon regaining its position, after the fall down the sides of the vial, it remained perfectly motionless for nearly a minute. Then, very quietly, it inserted the beak and began to feed. In ten minutes, it was gorged with blood, and the body was therefore much elongated. About eleven minutes after beginning to feed, the bug withdrew its beak, its body greatly distended with blood.

Another recently fed adult captured on September 24th, showed willingness to feed from the fingers of the hand on the afternoon of September 29th, when they were placed near it.

Accordingly, it was transferred to a vial, and the latter inverted over a portion of the under surface of the fore arm, at 6:08 P. M., in the presence of a bright light.

It tried to escape at first, but at 6:09 P. M., it inserted the beak and began to feed. The vial was then removed, leaving the insect attached to the arm. It was wholly unmindful of the light. The abdomen gradually commenced to swell, until at 6:16 P. M,, it was greatly distended, and cylindrical, apparently unable to hold more. Yet the insect remained attached until 6:18:15 P. M., when it withdrew the beak and began to run off. It now resembled a gravid termite female, all abdomen. At 6:20 P. M., it voided a drop of thick, dark, liquid excrement.

B. *Experiments with living mice.*

At 8 P. M., September 28th, three recently born mice were placed under a bell-jar, and three adults and two larvæ of *columbarius* added. They were left over night in a dark-room, and were found gorged with blood on the morning of September the 29th.

While placing them under the bell-jar the evening before, one of the adults accidently fell on the body of one of the young mice, which it immediately attacked. When its beak was inserted, the mouse jumped from the pain, and a struggle then ensued, the almost helpless little animal trying desperatively to dislodge the sucking insect by rolling and kicking. Several times, the bug lost its hold, but turned at once and renewed the attack, until at last, it obtained a position on the breast of the mouse, between the fore legs, where it was simply impossible for it to be reached. Here it fed until satisfied.

The insects showed no hesitancy in attacking these mice, after gaining access to them; but on account of the presence of light being necessary in order to watch them, they would not as a general rule, go at once to feed. Some do not seem to mind the light at all, however. This is seemingly dependent on the state of their appetite.

At 7.30 P. M., September the 29th, the experiment was repeated, using the same mice, now nearly exhausted from lack of nourishment. Two adults and one larva were left over night with the three mice. The following morning they were gorged with blood. The mice were dead.

Young mice are very sensitive to the attacks of these insects. They start with pain when bitten, and in their helpless way, struggle frantically to keep the insects away, or to dislodge them. But the activity and persistency of the "bed-bugs make their struggles useless."

The writers could not find any marked differences between *lectularius* and and *columbarius*, in their behavior towards the foregoing hosts. The former is perhaps, more bold and active than the latter.

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1897. Nuttall, George H. F. Zur Aufklärung der Rolle, welche die Insecten bei der Verbreitung der Pest spielen.–Ueber die Empfindlichkeit verschiedener Tiere für dieselbe. Eine experimentelle Studie.

Centralblatt f. Bakteriologie, Parasitenkunde, u. Infectionskrankheiten, Jena, Bd. XXII, erste abteilung, pp. 91–93. (Versuche mit Wanzen.)

1898. Nuttall, George H. F. Zur Aufklärung der Rolle, welche stechende Insekten bei der Verbreitung von Infektionskrankheiten spielen. Infektionsversuche an Mäusen mittels mit Milzbrand, Hühnercholera und Mäuseseptikämie infiezierter Wanzen und Flöhe.

Centralblatt f. Bakteriologie, Parasitenkunde, u. Infektionskrankheiten. Jena, Band XXIII, erste abteilung, pp. 625–635. Reviewed by Kübler, ib., 1899.

The writers are indebted to Dr. L. O. Howard, Chief of the Bureau of Entomology, U. S. Department of Agriculture, for his kindness in permitting the publication of this paper.

RECENT ENTOMOLOGICAL LITERATURE

American Insects, BY VERNON L. KELLOGG, PROFESSOR OF ENTOMOLOGY AND LECTURER ON BIONOMICS IN LELAND STANFORD JR. UNIVERSITY, WITH MANY ORIGINAL ILLUSTRATIONS BY MARY WELLMAN. HENRY HOLT & COMPANY 1905. 674 pages, 812 figures and 13 colored plates.

This work easily ranks as the most comprehensive volume treating of American insects yet produced. The great progress in entomology during the decade which has elapsed since the appearance of Comstock's Manual, has enabled the author to give more adequate treatment to the dragon flies, to the previously almost unknown Culicidae and to the part taken by insects in the transmission of diseases. This latter, comprising an entire chapter, is a new and exceedingly important addition to a comprehensive work on American insects. There is a general systematic account of all the principal groups with special discussions of insect structure, physiology, development, metamorphosis and ecology, portions of which have been greatly enriched by the author's personal investigations. The systematic part agrees largely with Comstock except that the Coleopteras Diptera and Lepidoptera are treated in the order named. The synoptic key, have been summarized in certain groups and in others there are valuable additions, particularly in the Odonata and Orthoptera. The treatment of the Coleoptera, considering the importance and popularity of the group, appears rather brief in comparison with the space usually accorded this order in other works. Considerable attention is devoted to the economic aspects of the subject and a decided preference for the more injurious forms is exhibited in discussing typical species of the various groups considered. A very large majority of our more destructive insects are noticed, with a summarized statement of the life history and directions for controlling these pests. The interesting problems presented by social communities such as white ants, true ants and bees receive considerable attention. The important relationship existing between insects and flowers, the value of color and pattern and their uses, are discussed somewhat fully in two philosophic and very suggestive chapters. The work closes with an appendix on collecting and rearing insects.

The subject matter is presented in an easy narrative style, though accuracy is not sacrificed for the sake of popularity. The work itself is plainly printed on excellent paper and the illustrations are generally of a high standard. The volume exhibits a thorough appreciation of and familiarity with recent investigations and, considering the immense field covered, it is not surprising that there should be a few typographical and other errors and some minor inconsistencies. This work brings together in one volume a vast amount of information and the author is to be congratulated upon having produced a very readable comprehensive work, which should prove attractive and exceedingly helpful to the amateur as well as essential to every investigator. E. P. F.

A Catalogue of the Erycinidae, WITH THE SYNONYMY BROUGHT DOWN TO OCTOBER, 1904, BY LEVI W. MENGEL, READING, PENN. PUBLISHED MAY, 1905.

This publication covering the Erycinidae of the world is of undoubted value to every collector working in this family. It will serve as a collection check book and also as a catalogue of reference. The amount of work involved in its preparation is little appreciated by the average collector, but is readily appreciated by scientists who have attempted any such complete record of specific names with reference to previous publications. The author states in his preface that the arrangement of any such publication in connection with family or generic succession is dependent upon the ideas of the scientist who takes up the work; that is, there are scarcely any two publications of this sort that agree in family or generic arrangement, and the arrangement that is followed by the average collector is one that has been suggested through publications which were readily purchasable; thus the order of Mr. Kirby's synonymic catalogue has been widely adopted, although others have published works not so readily obtainable with a totally different arrangement.

The specific arrangement of any such publication should not be put under too severe criticism. This publication of 161 pages represents an amount of detailed work that is not readily realized, and it is a volume which should be in the possession of every library and of every collector who is interested in this branch of entomological work. A. G. W.

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7c " " " " " " " Circulars.
7m " " " " " " " Miscellaneous publications.
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ECONOMIC ENTOMOLOGY.

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Crosby, C. R. The spiders of the Rochport cave, Mo., 4 Nov. [Describes male of *Troglohyphantes cavernicolus* Keys, hitherto unknown]. **Titus, E. S. G.** The cotton red-spider (*Tetranychus gloveri* Bks.), 7c no. 65. **Williams, S. R.** Anatomy of *Boophilus annulatus* Say, 191 xxxii, 313.

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See also Cockerell, under Lepidoptera.

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Established in 1874

VOLUME XIII

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[Exchange notices (not over five lines) inserted free for subscribers. Notices will be inserted in the order in which they are received, and those at the top of the column will be removed only when it is necessary to make room for new ones at the bottom.]

AMARA. Being engaged in the study of this genus, I will determine specimens for collectors. These should be sent numbered. I am also anxious to obtain species in other genera of Carabidae not in my collection, from all parts of the world, and will purchase or exchange for same. Roland Hayward, Readville, Mass.

WANTED—Eggs, larvae or pupae of grasshoppers, dragon-flies, beetles, bugs, etc. Will give tropical butterflies in exchange. Denton Bros., Wellesley, Mass.

WANTED—Material for the study of the hybrid or polymorphic butterflies of the genus *Basilarchia*, including larvae or pupae of *arthemis* or *astyanax*, imagos of *proserpina* or *arthechippus* or any specimens showing unusual characters. Liberal exchange. Specimens retained will be deposited in Museum of Comparative Zoology. W. L. W. Field, Milton, Mass.

LEPIDOPTERA—For exchange, fertile eggs of *Hemileuca maia*. Alfred C. Sampson, Sharon, Mass.

I have a few specimens of *C. calleta* and *cinctus* to exchange for rare *Sphingidae* or Pupae of same. W. T. Buxton, 17 Walter St., Somerville, Mass.

WANTED—Ova, larvae or pupae of *Limenitis ursula* and *arthemis*. Will give cash or exchange. H. H. Newcomb, 35 Court St., Boston, Mass.

Will collect Diptera, Hymenoptera, Hemiptera and Coleoptera. Would like in exchange, quantities of named or unnamed Buprestidae, Scarabaeidae, Cerambycidae and Chrysomelidae. Please write immediately to G. Chagnon, P. O. Box 186, Montreal, Canada.

Correspondence desired regarding Rhopalocera of North and South America, especially Argynnis, Papilio, Morpho, Caligo. Exchange or otherwise. T. H. Shepherd, 15 Hope View, Carr Lane, Shipley, Yorks., England.

EASTERN MASS. MOTHS WANTED in exchange for same. Also, reliable colored sketches of larvæ of same. C. V. Blackburn, 101 Pine St., Woburn, Mass.

Am willing to make contracts to collect for the season, with private collectors, museums colleges, or any public institution for insects of any order or group desired, either in large or small series. Duplicates of all orders for sale from Colorado, New Mexico, and Arizona. Correspondence solicited. Ernest J. Oslar, 4535 Raleigh St. Alcott P. O., Denver, Colorado.

WANTED—Records of captures of Connecticut insects—especially the rarer species—for the preparation of a State list. Orthoptera and Hymenoptera records desired at once. W. E. Britton, State Entomologist, New Haven, Conn.

CICINDELIDAE of the world wanted. Good exchange in all families of Coleoptera offered. H. F. Wickham, Iowa City, Iowa. U. S. A.

HIPPODAMIA—Live individuals and large masses for variation study desired. Insects collected to order in exchange. The following species especially wanted—H. moesta, 12-maculata and sinuata. R. H. Johnson, Station for Experimental Evolution, Cold Spring Harbor, N. Y.

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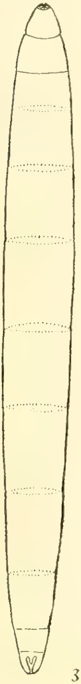

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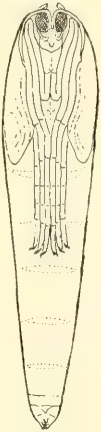

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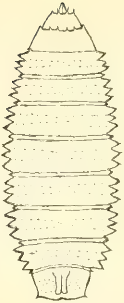

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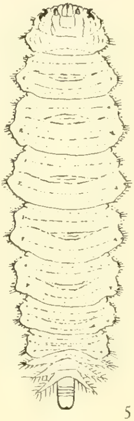

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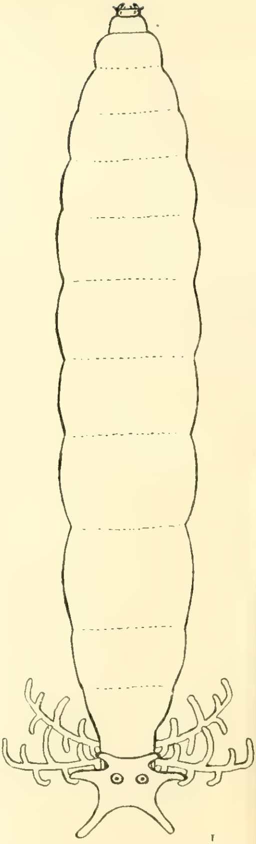

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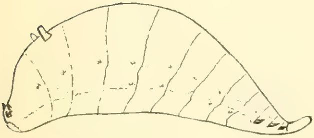

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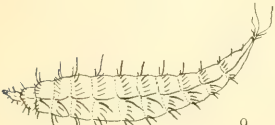

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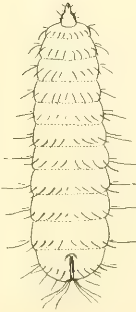

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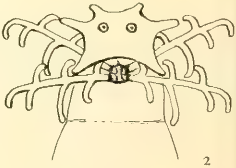

2

JOHNSON: DIPTEROUS LARVAE

PSYCHE

NOTES ON SOME DIPTEROUS LARVAE.

BY CHARLES W. JOHNSON, BOSTON, MASS.

While collecting at Riverton, N. J., on June 10, 1900, I found in a spring, a large and very peculiar larva. It was placed in an aquarium and for three days was quite active and seemed to be doing nicely. Its large size and the time of the year were both favorable for bringing it to maturity, but on the morning of the fourth day it was dead. As the aquarium was well balanced, I can only account for its death by the change in temperature, as the weather was very warm at the time, and the spring from which it was taken quite cool, about 60°.

While it was living I had a good opportunity to observe its habits and make several sketches, from which the drawings accompanying this article were made. The larva, when extended, was about 45 mm. in length; yellowish white in color, translucent, the alimentary tract, etc., being plainly visible, as the larva moved by expanding and contracting its body. When extended to its full length the posterior portion was elevated almost vertically, and the two pairs of peculiarly ramified appendages extending from the anal prominence were expanded to their full size as shown on Plate I, figures 1 and 2. At other times they were more or less contracted. Figure 2 is made to show the posterior portion vertically extended, and showing the ventral surface. The respiratory disk or stigmatal area bears three pairs of marginal projections, the lower and lateral ones being much the larger; spiracular openings yellow, with a narrow margin of brown and a black central spot. Head yellowish, with a short black line above the base of the antennae; tips of the antennae and mandibles, reddish brown.

The specimen preserved in alcohol, but giving very little idea of its appearance when living, was shown at a meeting of the Feldman Collecting Social, held in June, 1900, and from its size was referred doubtfully to *Tipula abdominalis* (Entom. News, xi, p. 578. 1900). Since that time the larva of *T. abdominalis* has been described and figured by Professor James G. Needham (see "Aquatic Insects in the Adirondacks:" N. Y. State Museum, Bull. 47, p. 575, pl. 35, figs. 1, 2. Sept., 1901). This shows a very different larva—more closely related to that of *Tipula eluta* Loew, described and figured by Mr. C. A. Hart (Bull. Ill. State Lab. Nat. Hist., iv., p. 210, pl. viii., figs. 32, 33. 1895).

It is thus evident that this is not the larva of any of our larger species of *Tipula*, and another correspondingly large form has to be considered. I am, therefore, inclined to look upon this as probably the larva of *Longurio testaceus Loew*. This species is not at all common. I have only seen one from Fairmount Park, Philadelphia, collected by Mr. H. D. Coyle, and two taken by the writer at the Delaware Water Gap, July 12, 15, 1898, along Dunnfield Creek, a cool mountain stream flowing into the Delaware on the New Jersey side. It is to be hoped that this description and figure will lead to the positive identification of this interesting larva.

LIMNOBIA TRIOCELLATA Osten Sacken. Plate I, Figs. 3, 4.

The larva of this species was found in considerable numbers in fungus in the woods at Riverside, near Auburndale, Mass., August 21, 1904. They commenced pupating the following day, and the imagos appeared on the 30 and 31.

The larva (Fig. 3), is about 18 mm. in length, cylindrical and gradually tapering towards the ends; color, a translucent yellowish white; mouth parts dark brown. The finely roughened transverse lines at the margins of the segments aid in its locomotion. The larva when found is apparently enveloped in a mucus-like covering, and when disturbed moves very rapidly through the fungus in either direction.

The pupa (Fig. 4) is about 13 mm. in length; yellowish at first, the wings and legs becoming a dark brown with age; antennae curve above the eyes, and disappear beneath the wings; the legs lie parallel to each other on the ventral surface, the tarsal claws ending near the middle of the fourth segment of the abdomen.

ARCHYTAS HYSTRIX Fabr.

This species was bred from *Datana major* Grote, July 7, 1905, by Mr. A. C. Sampson of Sharon, Mass. I can find no previous record of its host.

XYLOTA PIGRA Fabr. Pl. I, Figs. 5, 6.

While searching beneath the bark of pine logs for the larva of *Xylophagus*, I found the larva of this species in considerable numbers. It frequented the wet bark near the ground where there was more or less fermentation of the sappy portions of the wood and bast. The larva (Fig. 5) is about 14 mm. in length, of a dirty yellow or brownish color, with ten or eleven ill defined, rugosely wrinkled segments, covered with short hairs, which are somewhat longer on the sides. The first segment is armed on each side with a pair of black spines, the posterior one curved backwards; above the spines are small brown papillae; the posterior portion bears on each side three large, hairy, spine-like processes, and terminates with a prominent, shiny brown respiratory tube, showing slight annulations on the middle.

The larvae were collected near Auburndale, Mass., March 26, 1905. They commenced pupating March 31, and continued to do so until April 3, the imagos appearing from April 12 to 15. On June 16, 1904, I captured the adults of this species at the same locality. The pupa (Fig. 6), is about 10 mm. in length; dark brown in color, the black spines and small papillae of the larva being still present, with an additional pair of larger papillae above; the posterior portion also has a similar appearance to the larva, retaining the lateral processes and respiratory tube. The imago emerges through the upper portion of the first two segments.

The larva of this species was also found under similar conditions near South Framingham, Mass., by Mr. A. P. Morse.

Figure 7 represents a larva found by Mr. Owen Bryant at Cohasset, during the latter part of September, among some "woolly" aphids on the wild lettuce *(Lactuca elongata)*. The larva was very flat, about 7 mm. in length, slightly roughened, and of a dull yellowish color. It evidently belongs to the Syrphidae. I did not succeed in getting it to pupate.

ZABRACHIA POLITA Coquillett, Plate I, Figs. 8, 9.

Z. polita Coq., Aquatic Insects in the Adirondacks (N. Y. State Museum, Bull. 47, p. 585. 1901).

Associated with the larva of *Xylota pigra* (Fabr.) were a number of small larvae which proved to be this interesting little Stratiomyid, allied to the genus *Pachygaster*. The larva (Fig. 8) is about 5 mm. in length, somewhat flattened, of an obscure brownish color, shiny, with a transverse row of long hairs at or near the middle of each segment. The cephalic portion is narrow and of a reddish color; the posterior segment broadly rounded, with a narrow ventral opening and six long terminal hairs.

This larva cannot be properly classed as an aquatic insect, as the decayed bark in which the specimens were kept frequently became quite dry without any apparent injury, almost every specimen reaching maturity. Although not in water the larva has the same habit as those of *Odontomyia*, etc., of extending the posterior end of its body upward as shown in figure 9. The pupa is formed within the larval skin, with no apparent change, so that the date of pupation cannot be given. The imagos commenced to appear May 12, and continued to do so until June 20.

The adult emerges through a dorsal slit extending across the second, third and part of the fourth segments of the larval skin, the first segment being invariably removed in the process of emerging.

NORTH AMERICAN BEES OF THE GENERA ANDRENA AND MELITTA IN THE BRITISH MUSEUM.—I.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

When, in the summer of 1904, I visited the British Museum, one of my chief objects was to examine the types of the American species of *Andrena* described by F. Smith. These insects, described when comparatively little was known about American bees, had always been difficult to identify, and with a few exceptions the current identifications were open to more or less doubt. Some years ago, the Rev. F. D. Morice very kindly sent me a series of notes resulting from his examination of them, and these were published in the *Canadian Entomologist*, 1901; but further investigation was clearly desirable. I did not publish my notes on *Andrena* along with my other remarks on the British Museum bees (*Trans. Am. Ent. Soc.*, 1905), because it was intended to include them in a lengthy paper which Mr. Viereck expected to publish in 1905; but as this work (a review of all the known American *Andrenae*) is likely to be much delayed, I give them here.

Melitta americana (Smith).

Cilissa americana, Smith, ♀. Length 12 mm. or slightly over; facial foveæ apparently very broad, but ill-defined and not hairy; process of labrum low and broadly rounded; clypeus with a longitudinal median ridge, the upper part of which is narrow and grooved, while the lower part is very broad, and shining; rest of clypeus dull, with rather close punctures; mandibles broad at apex, with a short inner tooth; cheeks ordinary; mesothorax fairly shining, with quite close shallow punctures, which look as if caused by blows from a hammer; mesothorax and scutellum with a good deal of black hair, which, however, is not conspicuous, except perhaps at sides of scutellum; scutellum shining on disc, with definite punctures; postscutellum quite dull, with a curious subtesselate surface, and posteriorly with long hair; enclosure of metathorax triangular and ill-defined, slightly wrinkled at base; tegulæ with a conspicuous ferruginous spot; stigma yellowish-ferruginous, small and lanceolate; second submarginal cell not far from square, equally broad above and below, receiving the recurrent nervure at its middle; third submarginal cell very long, narrowed more than half to marginal; middle femora reddish, sharply keeled beneath; hind trochanters without any curled floccus; hair on outer face of hind tibiæ rather long and coarse, but not plumose; abdomen broad and dullish, with numerous distinct piliferous punctures, but not otherwise punctate; caudal fimbria dull black.

By the obliquely truncate apical joint of antennæ, and characters of legs, this is a veritable *Melitta* (= *Cilissa*); by the dark caudal fringe it is allied to *M. leporina*, but it is not that species. It was described vaguely from the "United States," but Mr. Lovell informs me that he has taken it at Waldoboro, Maine.

Andrena commoda (Smith).

♀. Expanse of wings about 22 mm.; facial foveæ quite broad, whitish; clypeus closely punctured, with a strong median ridge; tubercle on labrum large and quite broadly rounded, not nearly so pointed as Morice's account suggested; eye not separated from fovea by more than the usual narrow line; mesothorax minutely roughened, with small shallow punctures; mesothoracic area not distinctly defined, only minutely plicate basally; tibial scopa fulvo-ferruginous, not plumose; basal joint of hind tarsi broad, red, with ferruginous hair on inner side; abdomen not hairy as in *sayi*, having only piliferous punctures (but these very distinct), and not fasciate; fimbria a fine orange-fulvous. I noted that it suggested *A. corni*, Rob., and later Mr. Viereck sent me a specimen of *corni* to compare, and I found no difference.

Andrena integra, Smith.

♀. In Robertson's tables this runs to 11, and then runs out, because of unbanded abdomen and eye not widely separated from fovea. Compared with a species from Pennsylvania sent by Mr. Viereck, and supposed to be *integra*, the type was found to be a smaller and very different species, without abdominal hair-bands, and with the fimbria strong light ferruginous. It has strongly-marked, yellowish-white, *narrow* facial foveæ, adjacent to the eyes; clypeus microscopically tessellate, with scattered and shallow but distinct punctures; scutellum very shiny, its disc wholly impunctate; wings yellowish, stigma dark ferruginous.

Upon learning that the supposed *integra* was not that species, Mr. Viereck sent *A. lineata*, Prov., suggesting that this was the real *integra*. Careful comparisons showed that they were identical.

Andrena subtilis, Smith.

♀. Vancouver I. (*Lyall*). Supposed *subtilis*, sent by Mr. Viereck, was a much smaller and very different species. The real *subtilis* is a large, handsome species, with strongly fulvous hair on thorax; abdomen dark green, without any distinct bands; fimbria fulvous; stigma narrow, dark red-brown; process of labrum pointed; fovea broad, pale red, adjacent to eye. Size about equal to *vicina*. Later, Mr. Viereck sent for comparison a specimen of *A. seminigra*, Vier., which proved to be exactly the same.

Andrena algida, Smith.

♀. Hudson's Bay. Mr. Viereck sent a Philadelphia specimen of what had been taken for *algida* in this country; but the real *algida* proved to be quite a different species, with the following distinctive characters: larger; facial foveæ short, strongly reddish, seen from above occupying only about half distance between eye and antenna; process of labrum broadly rounded; third antennal joint longer; wings not yellowish, stigma and nervures duller and darker; abdomen more hairy, the hair of the bands longer and not so dense; segments 1 and 2, viewed laterally, with very conspicuous suberect hairs on hind margin; venter of abdomen dark reddish-brown; anal fimbria pale sooty; hind tibiæ, as well as their tarsi, dark reddish.

In Robertson's table, *algida* runs to *A. arabis*, Rob.; Mr. Viereck sent me *arabis* to compare, and I found them closely allied, but apparently distinct. *A arabis* has hair of abdomen yellowish, *algida* has it dull white, with the fimbria pale grey; the whole pubescence of *algida* is greyish, contrasting with the strongly ochreous of *arabis*; *arabis* has the flagellum beneath, and the claw-joints, very red, which is not the case in *algida*; the clypeus of *arabis* seems to have rather larger punctures than those of *algida*, though they are alike in character; in the dry state the eyes of *algida* are grey, of *arabis* black; in *arabis* the basal joint of hind tarsi within is darkened, in *algida* it is entirely pallid, with a pale ochreous tint.

Andrena fragilis, Smith.

Expanse of wings just over 14 mm. Runs to *platyparia* in Robertson's tables. Compared with *platyparia*, I found that *fragilis* had the hind tarsi and hair at apex of abdomen redder, but there was no essential difference.

Andrena placida, Smith.

♀. Length about 10½ mm. Fovea broad, seen from above pale reddish; process of labrum remarkably long and narrow; clypeus convex, microscopically tessellate, with quite widely separated punctures; disc of mesothorax dullish, with minute, well-separated punctures; metathorax truncate, the enclosure rugose-wrinkled, very ill-defined; hair of hind tibiæ plumose, at least in part; stigma ferruginous, quite large; abdomen with apparently a very faintly purplish tint, and with only piliferous punctures, and these very few and minute; fimbria dark purplish-chocolate; depressed hind margins of abdominal segments reddened; pygidial plate with a grooved V. This is not *A. cressoni.*

Andrena sodalis, Smith.

♀. Oaxaca. Ordinary-looking species, easily known by hind tibiæ and basal two-thirds (at least) of basal joint of hind tarsi clear light reddish-fulvous, strongly contrasting with the very dark brown hind femora, and apical part of basal joint of tarsus, as well as small joints of tarsus. The anterior and middle legs are also wholly very dark brown; the tibial scopa is strongly plumose. Facial foveæ fairly broad, their pubescence (seen from above) very dark seal brown; clypeus with quite a broad median impunctate band or area; abdomen practically impunctate.

A second specimen has only about half the basal joint of hind tarsi fulvous, junction of the two colors very oblique. Fimbria light brown, with a greyish tinge.

Andrena simplex, Smith.

♀. Length less than 10 mm.; clypeus minutely roughened, with scattered, shallow, piliferous punctures; labrum with reddish hair, contrasting with the dull white hair of clypeus; third antennal joint longer than 4+5; disc of mesothorax shining, with small, widely-separated punctures; fovea short, not widely separated from eye; area of metathorax merely roughened, very ill-defined; metathorax with a *concave* truncation; tegulæ dark red; stigma small, light reddish with a dark margin; third submarginal cell very broad above; first three segments of abdomen dark reddish; hair on outer face of hind tibiæ plumose; basal joint of middle tarsi quite broad.

Andrena hilaris, Smith.

Mr. Viereck sent one from Clementon, N. J. I found Smith's type identical, except that it had dark red legs.

Andrena auricoma, Smith.

Mr. Viereck sent a Corvallis, Oregon, example of this remarkable species, and it was the same as the type. The type has the first recurrent nervure joining submarginal cell some distance basad of the middle.

Andrena vicina, Smith.

A specimen from Philadelphia, Pa. (*Viereck*), of the species recognized as *vicina* in America, agreed with Smith's type.

Andrena nivalis, Smith.

A Milwaukee, Wis., specimen, sent as "*nivalis?*" by Mr. Viereck, proved to be Smith's species. In the type the longitudinal ridge on the clypeus was more prominent than in the Wisconsin specimen.

Andrena cærulea, Smith.

Compared with *Ptilandrena crypta*, Viereck, this was found to be very closely allied; they have just the same color and sculpture, and the same reddish, narrow, short facial fovea. *A. cærulea* is larger, and has the scopa of hind tibiæ dark brownish-grey, a good deal of long, erect, black hair on face, and some black hair at sides of mesothorax.

Andrena nubecula, Smith.

Compared with a Milwaukee specimen, and found the same; the species is well known. The type has lighter tegulæ than the Wisconsin example.

Andrena fimbriata, Smith.

Expanse of wings 20 mm. A specimen sent by Mr. Vierick is correctly named; the type is rather smaller, and has the first recurrent nervure joining second submarginal cell nearer its end. *A. fimbriata* is a homonym, and Dalla Torre changed it to *americana;* but Mr. Viereck finds that it is *hirticincta*, Provancher, and this name has priority.

Andrena fulvipennis, Smith.

I could not find a specimen of this in the collection.

Andrena flavoclypeata, Smith.

♂. This is generally understood to be *bipunctata*, Cresson, and the type runs to that species in Robertson's tables. Compared with a specimen of *bipunctata*, the type of *flavoclypeata* differs by being a little smaller, with the flagellum light reddish beneath except at base. The clypeus is a sort of pale orange, instead of a clear lemon yellow, but this may be due to cyanide. The tarsi are decidedly reddish.

Andrena perplexa, Smith.

Compared with a Corvallis, Oregon, example, sent by Mr. Viereck, the type differed by the bright orange-red hair on scutellum, and pubescence in general brighter; but they appeared to be the same species.

Andrena candida, Smith.

The type (Vancouver I., *Dr. Lyall*) was compared with a Corvallis, Oregon, specimen sent by Mr. Viereck, and found to be apparently the same species, but with rather strong varietal differences: —

Type.	*Corvallis specimen.*
Stigma dark red.	Stigma pale amber.
Abdomen strongly blue.	Abdomen greenish.
Facial foveæ dark chocolate color, very handsome.	Facial foveæ less conspicuous

MOUTH PARTS OF MOSQUITO LARVAE AS INDICATIVE OF HABITS.

BY EVELYN G. MITCHELL, WASHINGTON, D. C.

The larvae of the Culicidae follow the usual rule that a difference in the structure of the mouth parts is correlated with a corresponding difference in their food habits. This fact first forced itself upon the writer's attention when studying the habits of the Louisiana species, while making drawings and dissections for Dr. J. W. Dupree, and was later confirmed when making dissections and drawings of larvae of additional species for Dr. Howard's forthcoming monograph of this family.

These larvae fall into two categories, viz.: 1. Insectivorous, which, like *Megarhinus* and *Psorophora*, normally prey upon small aquatic larvae; and 2. Nonsectivorous, like *Culex*, which feed on Euglena and other protozoa, bacteria and vegetable matter; while between these groups are two others, somewhat intermediate, viz.: the *Uranotaenia* and *Anopheles* groups. That the differences in habits are correlated with marked differences in the structure of the mouth parts will be seen by the following critical comparison of the types of these four groups:

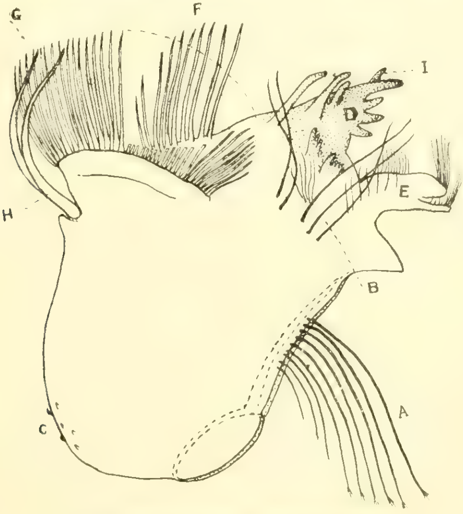

Fig 1. Mandible of *C. taeniorhynchus*.

I. NON-INSECTIVOROUS.	II. URANOTAENIA.	III. ANOPHELES.	IV. INSECTIVOROUS.
MOUTH BRUSHES.			
Hairs slender, very numerous, slightly pectinate or simple, projecting forward; adapted for making a current toward the mouth.	Same as I.	Same as I.	Stout, heavy, chitinised hairs, serrate on distal part; held at right angles to head or folded under. Adapted for seizing.
MANDIBLES. (See Fig. 1.) *Biting Part.* (D.)			
Comprises 1-10 of whole mandible. Anterior tooth heavy, rather blunt, not sharply differentiated from the three following teeth (of which the third is largest and longest), which do not recede sharply; two teeth, usually sharp and slender, at base of primary tooth. Some short, blunt teeth on ectal side of mandible below main group and not projecting so far. Arrangement primarily for crushing.	Same as I, except that the anterior tooth is especially heavy and blunt, and the teeth at base of primary tooth are heavy and blunt.	Heavily chitinised; about 1-6 of whole bulk. Anterior tooth sharp, conspicuous, not sharply differentiated from the three smaller teeth which are placed so that their tips form a sharply receding line; two rather blunt teeth atop of the primary tooth at its base; a bunch of many short, sharp spines and small teeth below last well developed tooth. Arrangement for tearing or crushing.	Very heavily chitinised, forming about one-fourth of bulk. Anterior tooth (especially in *Psorophora*) very long, pointed, well separated from rest, heavy; other teeth sharp. Arrangement for tearing. Much more irregular than in the foregoing forms. Stout accessory spine on side of base of primary tooth, ectal aspect, in *Psorophora*.
Articulate serrate spine. (I.)			
Sometimes deeply, sometimes bluntly serrate, narrow or broad, long or short, but never so wide as biting part, on ental side and projecting beyond biting part; four to twenty serrate-plumose, slender movable spines below it. Movement evidently like a chopper.	Of one very large tooth, serrate at base and differentiated from the four following sharp teeth; whole arrangement as large, though not so heavy, as the biting part. No small articulate spines.	A heavy, wide, flat, irregularly serrate spine; below it are two articulate, flat, narrow spines with hairs in the serrations.	Not present.
Lateral Comb. (G.)			
Many, never very heavy, elongate, somewhat curved, triangular	The three uppermost spines heavy and strongly chitinised; base	The three uppermost spines not conspicuously heavier than the rest.	Long, curved, heavy, immovable spines, especially heavy and finely

I.	II.	III.	IV.
plates, set with flat sides parallel on a chitinised ridge; somewhat movable in a line parallel to base; base coming in a curve from a point half way between the lateral and mesal margins to the ectal end of the cephalic (or top) margin with which it forms an acute angle.	heavy, not forming so acute an angle as in I, but, like III, at not so great an angle with base of primary tooth, nor so far forward as in IV.	Base as in II.	set in *Psorophora*, few as compared with other forms (especially in *Psorophora*), their base forming almost a right angle with top of mandible, and pushed forward almost to base of primary tooth.
Marginal Comb. (F.)			
Either fifteen to twenty, more or less, sigmoid, immovable spines, with the two or three nearest base of lateral comb more or less plumose; or a row of papillae bearing single, feathered hairs or very short hairs (in the latter case the papillae are moved over the top of the mandible onto the ental aspect).	None	Two fringed plates near base of biting part and four or five long fringed hairs set at a distance from these and against the upper end of the base of the lateral comb.	None.
Projection below last tooth. (E.)			
About size of biting part and resembling a turtle's head with open jaw; a tuft of small hairs on top of "head," one on the upper line of "lower jaw," a line, more or less, along back and side of "neck." A small, heavily chitinised projection below.	A huge, shapeless projection about one-fourth size of whole mandible, bearing on the lateral margin a row of short, hooked hairs and two bunches of slightly longer hairs on the side, joined with projection below it.	A distinct, rounded projection, having on top a small papilla with a few minute hairs. No projection below.	Projection below last teeth aborted into a few irregular projections in *Psorophora;* joined with the next lower projection and larger in *Megarhinus*, having a projection below it in *Psorophora*.
Simple articulate spines. (H.)			
On latero-cephalic angle below upper end of base of lateral comb; two slender, crescent-shaped.	Four large, flat, sharp spines, the outer ones about one-third longer than the inner, which are a little fringed, taper	Four large, flat, sharp spines, dilated at base; outer two smooth, rather sharply bent near base; inner two sigmoid, more	A single, heavy, sharp curved spine in *Psorophora;* two rather slender spines with three or four plumules in *Megar-*

I.	II.	III.	IV.
	to base and are not sigmoid.	or less fringed; all of about an equal length.	*hinus*.
Hairs between articulate simple spines and upper end of base of lateral comb, usually not present but sometimes 5-6, rarely a pair so well developed that they might almost be considered spines.	A large number of hairs about as long as the serrate pair of articulate spines.	Eight or 9 short, slender hairs.	Nine hairs.
Hairs. Group A. (See Fig. 1.)			
4-25 hairs, some of which are generally tufted at ends, occasionally a few are slightly plumose.	Two or 3 very large flat setae, serrate; the teeth may or may not end in small hairs.	About 22 hairs, those toward base of mandible split into 3 or 4 shreds at end.	About 25 long hairs in *Megarhinus*; 8-10 short hairs in *Psorophora*.
Group B. (See Fig. 1.)			
Two to 10 heavy hairs, occasionally split, in a scattered line between *A* group and lower end of base of lateral comb.	Eight to 16 graded hairs, somewhat split at tips, closely set in a group contiguous to *A*.	Four to five slender, short hairs well above *A*, near lower end of base of lateral comb.	Wanting.
Group C. (See Fig. 1.)			
Two to 12 small spines (except in Deinocerites, which see in summary) on the lower part of the lateral aspect.	Two to 5 small spines.	Two slim, fringed hairs on papillae with 8-9 broad, plumose, long hairs in a transverse row below.	Very few, minute, broad spines.
Maxilla. (Fig. 2)			
Cone-shaped, more or less flattened, always proportionately narrower than in Uranotenia (II).	A sort of flattened, irregular cone.	A parallelogram (approximately about 2 x 1).	Trapezoid, the cephalic aspect the longest in *Psorophora*; nearly square with a deep emargination in middle

	I.	II.	III.	IV.
				of cephalic edge in *Megarhinus*.
Palpus.	Not large, distinct, cylindrical, somewhat constricted about middle, top rounded irregularly, 4-5 short, blunt spines, reaches ¼-½ to top.	Not large, distinct, cylindrical, top flat, with 4 very large and 2 small, blunt spines (2 of the large spines sharp, 2 blunt; does not reach over ½ to top of cone.	Top about even with top of maxilla, very slightly rounded, with 4 large spines and 2 or 3 flat, sub-triangular plates articulated by the apex of the triangle; with a deep sinus between its upper part and the body of the maxilla; the lower part rounded and projecting below base of body of maxilla; upper part a truncate cone. A large, tree-like hair from a papilla on lateral aspect.	Projects above body of maxilla; bluntly rounded at apex in *Megarhinus*; truncate in *Psorophora*; with four stubby spines; springing direct from top of maxilla in *Psorophora*, from the base in *Megarhinus*, being much larger therefore in the latter; cylindrical.
Strip of chitin.	Narrow, very heavy, from top of cone to base, slightly curving from palpus as it approaches base and continuing into the heavy rim of chitin at base.	About the same as in I.	None.	None.
Spines.	Two, stout, more or less blunt, from papillae next to above chitinous strip on same side as palpus and about on a level with its top; their points usually reaching across strip of chitin.	Present, very large, slightly removed from strip.	Very short, on the farther side from palpus of an imaginary line parallel to palpus and dividing body of maxilla in half, and on the upper half of the side.	In *Megarhinus* the spines are near top on the side of the emargination nearest the palpus; in *Psorophora* they are near the top on the third of the body of the maxilla farthest from the pulpus.

I.	II.	III.	IV.
Tuft A. (See Fig. 2.) A large tuft of long or short movable hairs at apex, often a line extending down the chitinous strip toward the double spines.	Of immense, flat setae serrate on one side.	A row of papillae, bearing several short hairs each, extending along top of body of maxilla from end nearest palpus about half way; a row of erect, hooked hairs for about the same distance, continued into a thick mass of hairs curling down across the top; a bunch of short spines at end farthest from palpus.	In *Psorophora* a row of short, flat, triangular spines along the apex from base of pulpus, curling over and continued in a patch half down the side on the half away from the pulpus, at the third farthest from the pulpus these spines are very large, hooked and in 3 rows. In *Megarhinus* a large patch of straight, short spines and one long, slender spine on side of emargination nearest pulpus; a double row of large, hooked spines on farthest elevation, continued into a graded row of straight spines $\frac{1}{3}$ down mesal margin, and 1 hair-like spine.
Long patch of short hairs. Some slender, some spine-like or thickened and split, on side of chitin strip farthest from pulpus. Usually a few hairs on side next pulpus.	Same, but the hairs not thickened but closely set.	Many short, curved hairs in groups on upper $\frac{1}{3}$ next pulpus, set thickly on upper middle $\frac{1}{3}$ and upper and lower $\frac{1}{3}$ farthest from pulpus.	Wanting.
Labial Plate. Nine to 33 teeth; in general tending to 15-23 rather fine, evenly graded teeth except in the long breathing tubed species where the teeth show a tendency to irregularity difficult to describe but easy to see.	Coarse, bluntly rounded teeth, 11 in number. General shape of plate ellipsoidal, a regular outline.	Coarse, much separated, rather sharp, irregular teeth, 9. Not a regular curve.	Teeth tend to coarseness and to have center and end teeth largest in *Psorophora*.

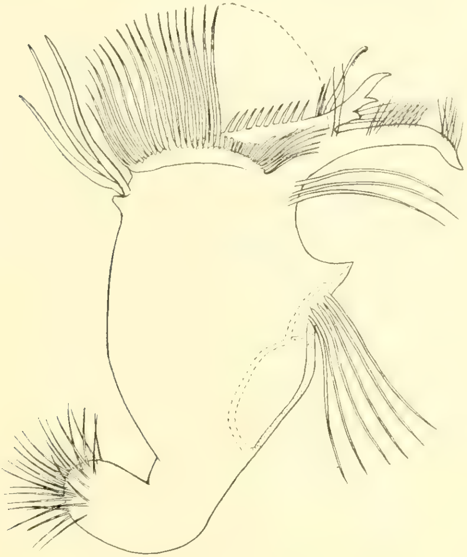

Fig. 2. Maxilla of *C. salinarius.*

As the above comparative scheme shows, in insectivorous forms the principal appendages of the mandibles and maxillae are sharp, heavy and fitted for tearing; or stiff, spiny, immovable, and adapted for holding the struggling prey. The corresponding appendages in the non-insectivorous forms, whose food is microscopic, are more blunt and better adapted for crushing; or are slender, more or less movable, and fitted (as the *A* tuft of the maxilla) for aiding the mouth brushes to draw food into the mouth; or (as the smaller hairs of the maxilla) for a sieve. The plates of the lateral comb on the mandible are movable in the plane of the base, and, so the writer thinks, help to direct food toward the crushing portion, the other comb acting as a sieve and the remaining appendages being sieves or tactile organs.

Anopheles and *Uranotaenia* seem to exactly correspond with neither of the foregoing groups. *Psorophora* we know will prey on larvae of other species and even turn cannibal if hard pressed. *Megarhinus* will do the same. *Psorophora*, however, can exist, temporarily if necessary, on a diet of *Euglena*, though it does not thrive on this, as Dr. Dupree proved when the writer was with him. *Anopheles* will bite each other viciously, tearing off the hairs so frequently that perfect specimens of the larvae are to be obtained only by isolation; will devour skins, occasionally kill other larvae and always eat any which die. *Uranotaenia* is supposed to have the same habits as *Anopheles*, save that, whereas *Anopheles* skims the surface, *Uranotaenia* feeds just below. From the shape of the mouth parts, however, the writer would judge the latter to be distinctive in its method, a vegetarian and also feeding on minute crustacea and the like.

In the non-insectivorous groups are two distinct types of mandible and maxilla. The facts on hand suggest that these are associated with two types of breathing tubes and antennae, as well as with different habits of feeding. The author hopes to make further observations when opportunity offers, not having hitherto paid special attention to this point.

The group with long breathing tubes (*M. atratus*, *C. pipiens*, *C. territans*, *C. C. restuans*, *C. salinarius*), feed with the tubes almost continually at the surface, sailing about by the movement of their mouth-brushes, and leaving the surface only when disturbed. Their food evidently floats freely, and is drawn in by the currents set up by the brushes. In these forms the antennae have very large and plumose tufts; the marginal comb on the mandible is reduced to papillae bearing a few hairs and moved over the top somewhat onto the opposite side from the lateral comb. The maxillae are of a pointed, sub-conical form, with the terminal hairs freely movable and very long, many of them as long as, or longer than, the body of the maxilla, with several long-plumose hairs in the tuft, which is mostly composed of single hairs. The plumose hairs are probably sensory, while the function of the simple hairs is probably only to brush in food.

C. discolor forms an apparent exception, having this type of maxilla and mandible, but when one considers that, although he feeds at the bottom, he lies on his back most of the time, and feeds on floating matter, his not feeding near the surface makes no great difference.

C. jamaicencis, *J. musica*, and *J. varipes* also belong to this type, though the latter two can stay at the bottom a long time if disturbed.

The bottom feeders, as far as known, have straight, stubby antennae, generally bare of spines, with one hair or a very few simple hairs in the tuft. The mandible has the marginal comb well developed, the maxilla is a flattened cone, the terminal tuft of stiff, straight hairs, which are rather short, is evidently for use in brushing over the debris at the bottom, where the very long, slender hairs would be a disadvantage. *C. dupreei*, with its very short antennae, and its bottom feeding habits, is a very good example. *C. triseriatus* lives in hollow trees, and feeds at the bottom of the hollow; the antennae, mandible and maxilla are all typical of this habit. To have such a type of mouth parts the larvae need not necessarily be bottom feeders; they may brush over the sides of a tank or floating or half-submerged objects, grasses, spirogyra, etc. There are maxillae which seem transitional, though there are only the two types of mandibles; and there are in some maxillae peculiar developments of the lateral hairs, which are probly related to some peculiar habit of feeding, or character of food.

Among the non-insectivorous larvae is one, *Deinocerites cancer*, that so distinctly and strikingly, in several respects, departs from the ordinary type of larvae as, so the writer believes, to justify its being placed in a new sub-family, DEINOCERITINAE. The head is sub-circular and is characterized by an angular projection of the chitin caudad of the base of each antenna. This lateral angle forms a groove, running on the ventral side of the head, in which groove the basal portion of the lateral aspect of the mandible moves in and out, so as to be visible from above, a thing which, so far as the writer knows, exists in no other culicid larva. The anal gills are entirely absent.

The maxilla affords no striking departure from the type, it being in general that of a larva feeding on floating objects.

The labial plate is different from others in that the teeth, instead of being broad at the base and coming gradually to a distinctly narrow point (with but few exceptions), are but little narrowed until they abruptly point off, are very long for their width and, especially, are all separated from each other by a space of more than their width, while the two basal are very much longer than any but the central (which is about twice the length of the rest), and are set caudad from the base of the next by about their own length.

The mandible is like no other (see fig. 3). The biting part is three, weak teeth, not heavily chitinised (the whole larva is almost transparent), set in a decidedly receding row. Normally, the non-insectivorous larvae have four teeth, not receding very much. The projection just below the teeth, instead of being about twice as long as wide, and having an "under jaw," is fully six times as long as wide, the tip pointed and bent down for about one-fourth the length. The marginal comb is nine short, sharp, stright spines. The chopper-like part is a sort of narrow hook, finely serrate at the distal end. There is a third articulate spine, shorter than the others, between the usual two, an odd number in this place being very unusual. But the distinguishing feature is the caudal portion of the lateral aspect. In other mandibles, so far as the writer can ascertain, this part forms an even, continuous curve with the rest of the mandible body and bears a very few minute spines, or (as in *Anopheles*), a row of fringed hairs. In *D. cancer* this portion of the mandible is produced, and in shape is like the thumb held on a plane with the hand and flexed at the second joint. The part flexed in the man-

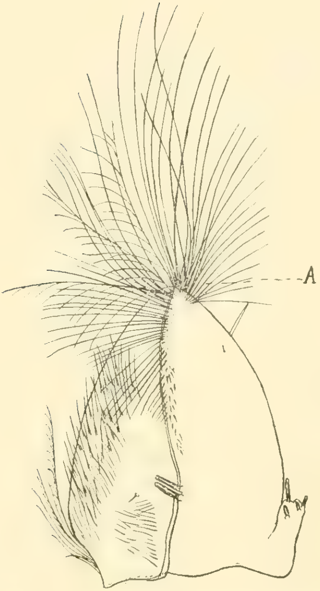

Fig. 3. Mandible of *Deinocerites cancer.*

dible seems to be rather soft as, although no suture can be seen, the projection is capable of a slight flexion and extension. The projection works in the trough formed by the angle of the head. Instead of the usual minute spines at this point there are about twenty-five long, slender spines placed in a group with their bases well separated. They are apparently somewhat movable. The function is difficult to imagine.

The adult is distinguished from all others by the unusually long antennae in both sexes; according to Mr. Coquillett, the second antennal joint is over fourteen times as long as wide, whereas in other forms of culicidae it is less than eight times as long as wide.

It will be noted in the forgoing comparative study that *Psorophora* falls into the same category with *Megarhinus*, to which it is much more nearly related both in anatomy and habits than to *Culex*, in the same sub-family with which it is at present classed. The larva, however, differs from *Megarhinus* in several important respects, not only in mouth parts but also in regard to external characters. In *Megharinus* the antennae are situated far forward, and the eyes are near the middle of the side of the head: in *Psorophora* the antennae are near the middle of the side of the head, and the eyes are near the caudal angle. On the thorax of *Megarhinus* are a number of stiff, coarse spines with spinules; no such spines occur in *Psorophora*. In *Megarhinus* the hairs of the abdomen are on large, heavily chitinised papillae, which is not the case in *Psorophora*. *Megarhinus* has the comb of the eighth segment represented by a chitinised plate from which spring two bristles and three minute tufts; the comb is present in *Psorophora*. The hairs of the ninth segment brush in *Megarhinus* are branched, not in tufts; in *Psorophora* they are simple and in tufts. The breathing tube in *Megarhinus* is without a pecten; *Psorophora* has a large pecten.

The adult *Megarhinus* has a strongly decurved proboscis, while in *Psorophora* it is straight. The depressed scales of the head and body in *Megarhinus* are much wider than in *Psorophora*; moreover, in *Megarhinus* the scales of the legs are never erect as in *Psorophora*. Therefore *Psorophora* can neither be placed in the same sub-family with *Megarhinus* nor with *Culex*, but should constitute a distinct sub-family, *Psorophorinae*.

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—LXIV.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Cymatophora matilda Dyar.

Egg. Ellipitical, evenly rounded, strongly flattened dorso-ventrally but no flat areas, scarcely any truncation or depression, rounded disk-like; surface uniformly covered with beautifully waved quadragonal or pentagonal reticulations, gently raised, the surface over all very minutely granular shagreened. Dark olviaceous green; size .7 x .5 x .3 mm Laid in a flat mass.

Stage I. Head rounded, scarcely bilobed, free; yellowish luteous, brown around the edge of head cap and forming a shade by the six, seed-like, black ocelli. Body small, moderate, not elongate, rapidly looping; luteous yellow, dorsum broadly shaded in sordid olivaceous with illy defined edges, not quite reaching the ends. Tubercles minute, concolorous, except on the sides of the thorax where they are brownish. Setae very fine, moderately long, minutely glandular tipped.

Stage II. Head rounded bilobed, free, pale yellowish, eye black; width .5 mm. Body moderate, not elongate, whitish green; a broad, dorsal purple black band from joint 2 to before the anal plate, tubercles and setae invisible, tubercles concolorous, setae very short, black; no shields.

Stage III. Head strongly bilobed, subcordate, dull luteous whitish, ocelli black; width .75 mm. Body rather short and stout, held flat to the leaf, green, annulate finely; a broad brown dorsal stripe on joints 2 to 13. Feet normal, green. Setae short, black; tubercles concolorous with body, invisible; shields undifferentiated.

Stage IV. Head rounded bilobed, vertical and clypeal sutures depressed, mouth short and rounded, yellowish green, not shining; width 1.2 mm. Body short, stout, segments hardly longer than wide, smooth, pale green, not very opaque yellowish. A broad, diffuse brown dorsal stripe, obsolete at the ends, especially anterioly. A pair of stout, short anal prongs; feet green; no shields; tubercles and setae obsolete, the setae very short and dark.

The larvae ate aspen, but did not flourish, all dying in stage iv. I think, however, that they had reached the last stage. Eggs obtained at Kaslo, British Columbia.

RECENT ENTOMOLOGICAL LITERATURE

Illustrations of Diurnal Lepidoptera with Descriptions: by Andrew Gray Weeks, Jr. The University Press, Cambridge, 1905.

This volume is perhaps the most important addition to the literature of South American Lepidoptera of recent years. Beginning with a handsome steel engraving of Dr. Samuel H. Scudder, there follow descriptions of 81 hitherto undescribed or figured species of Diurnals collected in Bolivia in 1898-9 by Mr. Wm. J. Gerhard who headed an expedition to this unexplored region, the expense of which was borne by the author.

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Too much praise cannot be bestowed upon the 45 lithographic plates of the butterflies described. Nothing finer has been produced and it would seem that perfection in this line had at last been reached. The original water-color sketches were by J. Henry Blake, the well-known artist. Both the upper and under surfaces are shown and for minuteness of detail and faithfulness of reproduction the figures are all that can be desired.

Mr. Weeks deserves great credit for giving to the world the result of his labors in such a beautiful volume and it is a pity that all otherscan not follow his example by publishing plates with new descriptions.

H. H. N.

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[Exchange notices (not over five lines) inserted free for subscribers. Notices will be inserted in the order in which they are received, and those at the top of the column will be removed only when it is necessary to make room for new ones at the bottom.]

AMARA. Being engaged in the study of this genus, I will determine specimens for collectors. These should be sent numbered. I am also anxious to obtain species in other genera of Carabidae not in my collection, from all parts of the world, and will purchase or exchange for same. Roland Hayward, Readville, Mass.

WANTED—Eggs, larvae or pupae of grasshoppers, dragon-flies, beetles, bugs, etc. Will give tropical butterflies in exchange. Denton Bros., Wellesley, Mass.

WANTED—Material for the study of the hybrid or polymorphic butterflies of the genus *Basilarchia*, including larvae or pupae of *arthemis* or *astyanax*, imagos of *proserpina* or *arthechippus* or any specimens showing unusual characters. Liberal exchange. Specimens retained will be deposited in Museum of Comparative Zoology. W. L. W. Field, Milton, Mass.

LEPIDOPTERA—For exchange, fertile eggs of *Hemileuca maia*. Alfred C. Sampson, Sharon, Mass.

I have a few specimens of *C. calleta* and *cinctus* to exchange for rare *Sphingidae* or Pupae of same. W. T. Buxton, 17 Walter St., Somerville, Mass.

WANTED—Ova, larvae or pupae of *Limenitis ursula* and *arthemis*. Will give cash or exchange. H. H. Newcomb, 35 Court St., Boston, Mass.

Will collect Diptera, Hymenoptera, Hemiptera and Coleoptera. Would like in exchange, quantities of named or unnamed Buprestidae, Scarabaeidae, Cerambycidae and Chrysomelidae. Please write immediately to G. Chagnon, P. O. Box 186, Montreal, Canada.

Correspondence desired regarding Rhopalocera of North and South America, especially Argynnis, Papilio, Morpho, Caligo. Exchange or otherwise. T. H. Shepherd 15 Hope View, Carr Lane, Shipley, Yorks., England.

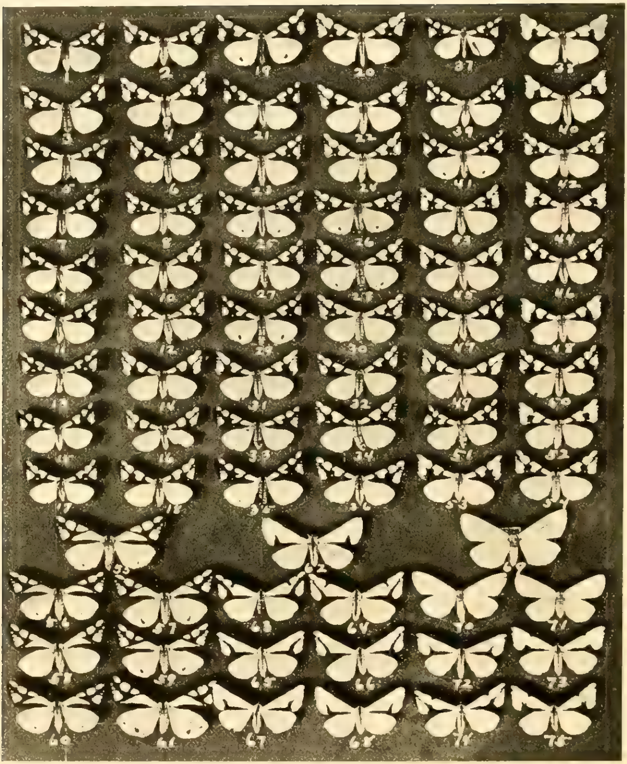
EASTERN MASS. MOTHS WANTED in exchange for same. Also, reliable colored sketches of larvæ of same. C. V. Blackburn, 101 Pine St., Woburn, Mass.

Am willing to make contracts to collect for the season, with private collectors, museums, colleges, or any public institution for insects of any order or group desired, either in large or small series. Duplicates of all orders for sale from Colorado, New Mexico, and Arizona. Correspondence solicited. Ernest J. Oslar, 4535 Raleigh St. Alcott P. O., Denver, Colorado.

WANTED—Records of captures of Connecticut insects—especially the rarer species—for the preparation of a State list. Orthoptera and Hymenoptera records desired at once. W. E. Britton, State Entomologist, New Haven, Conn.

CICINDELIDAE of the world wanted. Good exchange in all families of Coleoptera offered. H. F. Wickham, Iowa City, Iowa. U. S. A.

HIPPODAMIA—Live individuals and large masses for variation study desired. Insects collected to order in exchange. The following species especially wanted—H. moesta, 12-maculata and sinuata. R. H. Johnson, Station for Experimental Evolution, Cold Spring Harbor, N. Y.



Foster: Haploas.

FURTHER BREEDING EXPERIMENTS WITH HAPLOAS

BY F. H. FOSTER, CLAREMONT, N. H.

In the Entomological News for March, 1901, the writer gave some account of breeding experiments with Haploas. Experiments were continued during the four following seasons with a view to determining the limits of variation in the race of *Haploa confusa* occurring near Claremont and to working out more thoroughly the life histories of the other forms of the genus and their mutual relations. Efforts to breed successive generations from the same stock have been but partly successful owing to the difficulty of carrying the larvae in sufficient numbers through the hibernation.

Haploa confusa

From moths bred from wild larvae taken at Claremont in May, 1901, three successful pairings were obtained, viz:

Pair No. 1. Pl. II, Fig. 1 and Fig. 2 parents.

24 ♂—14 ♀ (See Pl. II, Figs. 3 to 18 for selected series of progeny)

Pair No. 2. Pl. II, Fig. 19 and Fig. 20 parents.

45 ♂—16 ♀ (See Pl. II, Figs. 21 to 36 for selected series of progeny)

Pair No. 3. Pl. II, Fig. 37 and Fig. 38 parents.

20 ♂—16 ♀ (See Pl. II, Figs. 39 to 54 for selected series of progeny)

A new supply of larvae was obtained in 1903 and three successful pairings were obtained from which were reared

from Pair No. 1 13 ♂ 6 ♀
" " No. 2 11 ♂ 4 ♀
" " No. 3 10 ♂ 8 ♀

These 1902 broods present no character materially different from the three 1901 series illustrated on plate.

Examination of the several hundred moths reared from our local race warrants the following conclusions.

1. The *confusa* type like figs. 1 and 2, Pl. 1 is the dominate form in this locality
2. While in any given brood the progeny vary considerably among themselves, striking departures from typical *confusa* are very infrequent.
3. The greatest divergence is in disappearance in occasional specimens of the brown cross-bands on primaries, this tendency being stronger in the females.
4. Some degree of sexual dimorphism exists, the males tending to show a greater extent of brown and the females a greater extent of white.
5. Occasional specimens occur conforming closely to Boisduval's type of *lecontei*. (Compare Pl. II, Figs. 45 and 49 with figure of type here reproduced.)

In the broods above referred to no instance of yellow in the ground color of the wings occurred, from which I conclude that the brood illustrated in Mar. 1901 Ent. News, which contained both yellow winged and white winged forms, contained a mixture of *clymene* blood due to some antecedent crossing. That such crossing sometimes occurs admits of little doubt. Strecker has reported taking *clymene* and *lecontei* in coitu from which resulted progeny like *lecontei* with yellow ground color. (See Proc. Davenport Academy of Nat Sci. V. II p. 275) and several aberrant individuals reared from wild larvae taken at Claremont can be best accounted for on the theory that they are mongrels. (See figs. 1, 2, 5 and 6 Pl. III). *Clymene* inhabits the same immediate locality from which most of the *confusa* material has been obtained.

Efforts have been made to obtain a *clymene x confusa* cross but six attempted pairings were unsuccessful.

H. lecontei var. confinis

In 1901, through the kindness of Mr. G. M. Dodge of Louisiana, Mo., I received eggs laid by a captured ♀ Var. *confinis*. From these were reared seven moths, two ♂ and five ♀, all of the fully marked *confinis* pattern and quite uniform.

H. colona var. reversa

In 1904 Mr. Dodge sent me two females of Var. *reversa* one of which is shown on Pl. II at fig. 55. These laid eggs from which were bred in all 21

♂ 14 ♀ fairly uniform in markings and showing no marked departure from the parents. Figs. 56 to 61, Pl. II show the range of variation in the series.

A wider variation than this occurs among these moths as shown by a selected series of captured specimens sent me by Mr. Dodge in which several specimens are immaculate white (*var fulvicosta*) and others intergrading between *fulvicosta* and *reversa*.

In this species and in *lecontei* both of which have immaculate forms, the examples I have examined indicate that the immaculate specimens are more common than those that can be really classed as intergrades. This suggests the theory that the immaculate forms are really "mutations" in the sense in which De Vries uses the word. This is further supported by the following case.

H. lecontei var. vestalis

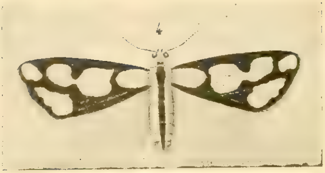
A captured ♀ *vestalis* (fig. 69 Pl. II) sent me by Mr. Dodge in 1904 laid fertile eggs from which were reared 16 ♂, and 10 ♀. Of these 10 ♂ and 8 ♀ were like the mother, immaculate. (See fig. 70, Pl. II). 6 ♂ and 2 ♀ were marked with brown, showing patterns referable to var. *militaris* (fig. 74) var. *confinis* (fig. 75) and var. *harrisii* (fig. 72).

H. lecontei var. harrisii Dyar

A captured ♀ *harrisii* (Pl. I, fig. 62) sent me in 1904 by Mr. H. D. Merrick from New Brighton, Pa., laid eggs from which were bred 3 ♂ and 3 ♀ (see Pl. II, figs. 63-68). These showed quite a range for so small a series, containing forms referable to vars. *harrisii*, *confinis* and *militaris*.

Typical lecontei Boisd

It seems unfortunate that the type of a species having so many varieties should have been based upon one of the least common of its forms. (See accompanying figure which is a reproduction of Boisduval's illustration of his type.) This form is very rare among collections I have examined. Only two or three moths of those obtained in this locality come very close to it. Figs. 3 and 4 Pl. II bred from larvae taken near Claremont are nearest to the type of any in my collection.



Type of *H. Lecontei* Boisd.
(Reproduction of Boisduval's figure.)

H. clymene

A small series of *clymene* bred from a captured ♀ sent by Mr. Merrick showed no noteworthy variations. *Clymene* appears to be the most constant of any of the species of the genus.

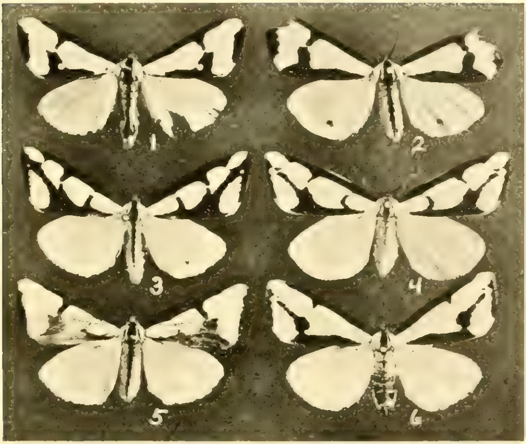
Larval Characters

The larval differences in the genus are not wide and do not appear until after the first or second moult. The following table shows the main points of contrast in the mature larvae:

	DORSAL STRIPE	LATERAL STRIPE	HAIRS
colona	deep red	deep yellow	black or gray
clymene	dull yellow	dull yellow	yellow brown
contigua	dull black	pale yellow	whitish gray
lecontei	yellow orange	yellow	yellowish
var. confinis	black	yellow	black
var. vestalis	dull yellow	dull yellow	black and gray
confusa	bright yellow sometimes orange	dull yellow	black

Studies of the ♀ genitalia have not revealed any constant specific characters in this genus. Differences in form of these organs occur between individuals of the same species and as wide as between those of different species.

The writer is indebted to Mr. G. M. Dodge and Mr. H. D. Merrick for their kind interest in furnishing material for these experiments.



FOSTER: HAPLOAS.

NORTH AMERICAN BEES OF THE GENERA ANDRENA AND MELITTA IN THE BRITISH MUSEUM.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

Andrena aliena, Smith.

St. John's Bluff. Mr. Viereck sent a species of the *Trachandrena* group from Georgia, which was taken for *aliena*; but the true *aliena* is quite different and apparently should be referred to the *Ptilandrena* group. Its distinctive characters, in comparison with the Georgia species, are as follows:

Larger; fimbria lighter and redder; hair-bands very distinct on segments 2 to 4, but broadly interrupted on 2; hind margins of abdominal segments strongly yellowish; punctures of abdomen much less strong and distinct, especially on first segment; area of metathorax triangular, delicately *transversely* striate, not at all longitudinally ridged, not bounded by an elevated rim; wings practically clear; tegulae small, dark reddish, convex, extremely shiny; mesothorax shining; tibiae and tarsi dark, nowhere strongly reddened: facial foveae practically obsolete (a short area without punctures or pubescence adjacent to upper part of eye); hair at sides of face very white; a strong raised line from middle ocellus to level of antennae antennal joint 3 about as long as 4+5; eyes converging below; stigma narrow, dark reddish, the parts before and behind the marginal nervure about equal; first recurrent nervure joining second submarginal cell at or almost at its middle; marginal cell narrow, its tip distinctly away from costa; outer scopa of hind tibiae very long, somewhat dusky, especially towards base, and very strongly plumose. Altogether, this is a remarkable species.

Andrena frigida, Smith

Mr. Viereck sent for comparison a presumed *frigida* from Seattle, Wash. Comparison with the type showed that they had the same general appearance, pubescence, etc. but although very closely allied, they are not the same species. The type *frigida* differed as follows: stigma lighter and yellower; second submarginal cell larger, and basal nervure meeting transverse-medial; abdomen broader; hind margins of abdominal segments dark reddish; third antennal joint longer than 4+5; facial fovea broad, dark purple-brown (black in Seattle insect); lateral hairs of face, overlapping fovea, black; process of labrum all shiny, narrowly submarginately truncate, with sloping sides (in the Seattle insect with a dull apical protuberant area.)

Andrena moesta, Smith

A Corvallis, Oregon, specimen regarded as *moesta* was sent by Mr. Viereck. Compared with the type, I found the following resemblances and differences: type has outer margin of third submarginal cell much more curved, and a light amber stigma (stigma is dark brown in the Corvallis species): both have the same black facial fovea, the same pubescence, etc., and the abdomen is the same in both; type has fourth and base of fifth antennal joints reddish beneath, but this is not very conspicuous; tegulae of type are distincly reddish behind.

The male type of *moesta* has long and falcate mandibles, without any tooth beneath or at base; cheeks produced to an angle behind.

The Corvallis insect probably should stand as a subspecies. It is recorded by Viereck in *Canad. Entom.* 1904, p. 224.

Andrena (*Trachandrena*) *miranda*, Smith

The type, compared with a supposed *miranda* sent by Mr. Viereck, differed thus:—Ridges of metathoracic enclosure stronger, the surface more shining between; scutellum more densely (though irregularly) punctured, and the punctures larger: when the thorax is viewed from above, the hair of tubercles, etc. in front of the wings, is seen to be strongly yellowish; facial foveae inclining to yellowish grey; an extremely narrow line between facial foveae and eye (a narrow but much broader area in the supposed *miranda*); punctures of clypeus apparently rather larger; third submarginal cell much more narrowed above, narrower above than second. The type has the tibiae and tarsi dark red; it has *not* the margins of the abdominal segments testaceous, or it would seem to run to *claytoniae* in Robertson's tables.

Smith's male *miranda* appears to run in Robertson's tables to *mariae*, or it might be held to run to *claytoniae*. The abdomen is more or less reddish-brown. By the lighter stigma, much less strongly punctured abdomen, etc. it appears not to belong to the same species as the ♀ type.

Andrena fastuosa, Smith

♀ The type is very like *A. argemonis*, Ckll.; it differs by having more black on abdomen, only the second segment being entirely red, or more red than black. The process of labrum is narrower; apex of wings not so dark; first abdominal segment broader. *A. argemonis* is an idiomorph of *fastuosa*.

Andrena errans, Smith

♀ Vancouver I. (*Lyall*). The type looks like *A. vicina* and *carlini*. Hair of face, cheeks, and pleura black: although the wings are quite dark, the stigma is dull amber; clypeus has very close, large punctures, and a well-defined longitudinal ridge; hair of metathorax black, and its enclosure is larger than in *vicina*, its apical angle noticeably larger; it is minutely roughened, with delicate raised wrinkles basally; process of labrum similar to that of *vicina*, but with the truncation not so broad; hair of occiput dark, but there is a tuft of light fulvous hair directed forwards over the ocelli: discs of abdominal segments beyond the first with rather abundant short erect black hair. Perhaps *A. pluvialis*, Ckll., should not be separated specifically from this. The British Museum series consists of six specimens, not all of one species, but the above remarks are based on the one bearing the type label.

Andrena obscuripennis, Smith

♀ A very fine species with extremely dark wings, which expand 30mm. Abdomen with strong punctures: stigma small: tibial scopa dense; area of metathorax pointed behind, not truncate, raised margin slight; anterior middle of clypeus dark red.

Andrena clypeata, Smith

Differs from *A. bipunctata* by being a little smaller (expanse of wings 12mm.) abdomen dark brown. Flagellum dark as in *bicpunctata*; third antennal joint longer than 4, but not nearly as long as 4–5; clypeus yellow with two black spots. Runs to *bipunctata* in Robertson's tables, except that the abdomen is not strictly black. It seems conspecific with *bipunctata*, or perhaps a Floridian race.

Andrena victima, Smith.

♀ The type is stylopized. Fimbria dark brown, a sort of purplish sooty; abdomen not fasciate, sericeous, with only small piliferous punctures; hair of scutellum quite bright orange-fulvous, all the thoracic hair being of this color, though not everywhere so bright; tibial scopa pale orange-fulvous.

The male (type of *A. desponsa*) is also stylopized. In Robertson's tables it seems to run closest to *sayi*. The area of metathorax has some little straight basal ridges, as though puckered. Second submarginal cell large, with recurrent nervure joining it at the middle. Cheeks ordinary.

Andrena hirticeps, Smith

♂ type. Cheeks very broad, angled behind, the angle somewhat above level of middle of eye; mandibles simple at base; hair of clypeus long, white; of sides of face black; third antennal joint about as long as 4+5; nervures and stigma rather light red; abdomen sericeous, with no true punctures; four narlow white hair-bands on *ventral* surface of abdomen. Not in Robertson's tables. The apical ventral valve is broad and emarginate, that is to say, obcordate

Andrena agilis, Smith (Mexico)

♂ type. Hair on sides of face long and black; black hair at junction of cheeks and occiput; large yellow mark on clypeus, rounded above and below, and notched at the sides, with the form of a young agaric with a very thick stipe; wings seem unusually large; basal nervure falling short of transverse-medial by a moderate distance; second submarginal cell at least as broad above as below; third submarginal very broad above; base of abdomen slender.

Andrena simulata, Smith (Mexico)

Hair of thorax quite lively fulvous or tawny; in type specimen the middle of thorax is bare, the hair having apparently been rubbed off. Facial foveae deep, pubescent, brown seen from above, having the form of a somewhat oblique band of no great breadth, its upper end close to the outer ocellus, its lower close to the eye, at about the level of the antennae; thorax and abdomen shining, abdomen broad; tegulae clear amber; first recurrent nervure joining second submarginal cell far beyond its middle.

Andrena (*Pterandrena*) *discreta*, Smith. (Mexico).

Very peculiar for having the abdomen except first segment red (clouded with black), densely covered with short orange hair; fimbria orange; first joint of hind tarsus broad, red; first recurrent nervure joining second submarginal cell *before* its middle; stigma small; facial foveae rather broad, not distinctly separated from eye; first joint of labial palpi curved; about as long as the other three together; hair of thorax fulvo-ferruginous; tegulae amber; tibial scopa dense, plumose.

Andrena modesta, Smith (Mexico)

♀ *Marginal cell squarely* (or rather slightly obliquely) *truncate*; *basal nervure falling far short of transverse-medial*: first recurrent nervure joining second submarginal cell conspicuously beyond its middle; *face black*, very little hairy, facial quadrangle broader than long; *tongue short* (i. e. not as in the Panurgids), maxillary palpi 6-jointed; facial foveae deeply impressed *but not pubescent*, in form small, short and narrow, close to upper part of eye; *area of metathorax not distinct*; abdomen very shiny, yellowish-red, blackened at base and apex. This is not an *Andrena*; it must stand for the present as *Protandrena modesta*, but it is at least the type of a new subgenus of *Protandrena*, which may be called *Austrandrena*. Its principal characters are italicized above.

NEW ANTS FROM NEW ENGLAND.

BY WILLIAM MORTON WHEELER.

While preparing a list of the ants of New England for the Boston Society of Natural History, I have come upon the following new forms in the Museum of Comparative Zoology collection kindly sent me for study by Mr. Samuel Henshaw, in a collection of Massachusetts ants made by Mr. A. P. Morse, and among the material collected by myself at Woods Hole, Massachusetts and Colebrook, Connecticut:

1. *Myrmica rubra laevinodis* Nylander var. *bruesi* var. nov.

A number of workers, females and males taken by Mr. C. T. Brues and myself during 1900 and 1902 from a few large colonies nesting under stones at the edge of Fay's Woods, Woods Hole, Mass., agree very closely with European specimens of *M. laevinodis* from Russia, Austria, Germany, England and Scotland in my collection. The thorax of the workers of the American form is smoother, more shining and less regularly sculptured than in the European specimens, but I am unable to find any other differences of importance, and therefore establish this variety with some hesitation. I should be inclined to regard it as directly imported from Europe were it not that Forel has described two subspecies of *M. rubra* (*M. neolaevinodis* and *M. champlaini*) from New York and Canada respectively, both allied to the European *laevinodis* but with distinctive characters. The former has short antennæ, with the tips of the scapes extending only a short distance beyond the posterior corners of the head, the latter has very short epinotal spines. It thus appears that America possesses indigenous forms closely related to *laevinodis*, just as it has long been known to possess numerous varieties of the other boreal and subboreal subspecies of *M. rubra*.

2. *Lasius flavus nearcticus* subsp. nov.

Lasius flavus Emery, Zool. Jahrb. Abth. f. Syst. VII, 1893, p. 640,

Lasius flavus subsp. *myops* Emery, *ibid.* VIII, 1894, p. 334.

Lasius myops Wheeler, Bull. Am. Mus. Nat. Hist. XXI, 1905, p. 397.

This form, which Emery and myself have been regarding as *L. flavus myops* Forel, originally described from the Mediterranean Region, is certainly distinct, as I find by comparison of workers from Illinois, Massachusetts, Connecticut, New York and New Jersey with three typical workers kindly sent me by Professor Forel. According to this authority *myops* is distinguished from the typical *flavus* of Europe "by its much smaller eyes, paler color, smaller and less variable stature, the absence of large reddish brown individuals, and finally by its predilection of warm, arid regions, where it lives under stones, unlike the true *flavus,* which prefers fat, humid meadows and makes large, compact mound nests." The worker of our American form of *flavus* undoubtedly resembles *myops* more closely than it does the typical *flavus* in the small eyes and paler color, but it is somewhat larger than *myops* (2.3-2.6 mm.), has the head and thorax smoother and more shining and the eyes proportionally even smaller. It differs, moreover, from *myops* in its habits, as it is found only in damp soil in shady woods, where it nests under dead leaves, stones or logs in colonies which are very small compared with those of the European *flavus.* These ethological differences are, in my estimation, a clearer indication of the independent subspecific rank of the American form than the morphological characters, although the discovery of the females and males of *myops* and their comparison with the corresponding phases of *nearcticus* may facilitate the separation of the two forms in our collections.

3. *Formica morsei* sp. nov.

☿ *Worker.* (Plate IV. Fig. 1 a-c). Length 3.5-55 mm.

With the habitus of a small *F. rufa.* Mandibles 8-toothed. Palpi rather long. Head, excluding the mandibles, distinctly longer than broad; cheeks long, slightly flattened, converging in front, posterior border and angles convex and rounded. Clypeus convex, carinate, with entire, rounded anterior border. Antennæ slender; four basal joints of funiculus longer and more slender than the terminal joints. Thorax in profile with deep mesonotal constriction, the pro-and mesonotum together and the epinotum singly, rounded and convex. Petiole much narrower than the epinotum, both its anterior and posterior surfaces alike convex in profile; seen from behind the border is broadly rounded, in some specimens faintly emarginate in the middle, but not produced upward at this point as in many forms of the *rufa* group. The edge is rather blunt. Gaster large. Legs of the usual conformation.

Mandibles shining, sharply striatopunctate. Anterior portion of head, clypeus, frontal area, lower surface of thorax and gaster, shining; remainder of body subopaque, very finely shagreened; upper surface of gaster with a slightly oily luster.

Hairs white, obtuse, suberect and very sparse on the upper surface of the head, thorax and gaster; nearly always completely absent on the lower surface of the head and petiolar border. Femora naked; tibiae with a row of tapering hairs on their flexor surfaces. Pubescence white, extremely short and sparse, so that it is almost invisible except on the upper surface of the gaster.

Reddish yellow; borders of mandibles black; anterior border of clypeus, vertex, upper surface of pro-and mesonotum, femora, tibiae, apical antennal joints, and gaster more or less infuscated; anal region yellow. In many specimens the upper surface of the head is more reddish than the remainder of the body but there is little difference in coloration between the smallest and largest workers.

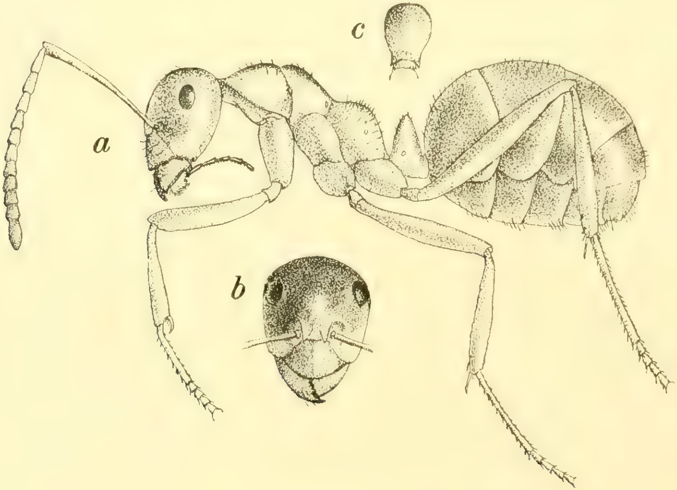
Described from many workers taken by Mr. A. P. Morse from a flourishing colony at South Natick, Mass. This form is very closely related to some of the smaller American *Formicae* of the *rufa* group. Its exact status and affinities, however, cannot be determined without a knowledge of the female. It can hardly be a mere variety or subspecies of *F. rufa* proper, and it certainly has a very different habitus in coloration and pubescence from any of the allied species known to me.

4. *Formica impexa* Wheeler.

Of this interesting species, originally described from workers only, taken in the Porcupine Mountains of Northern Michigan, Mr. A. P. Morse has recently discovered a colony at Sherborne, near East Holliston, Massachusetts. It was nesting in the upright trunk of a white pine, between bark and wood, about three feet from the ground and contained a few of the hitherto unknown females. These very closely resemble in their diminutive size (4.5 mm. in length) and coloration the females of the species which I have described as *F. microgyna, nevadensis* and *nepticula*, but the whole body, antennal scapes and legs are covered with long, suberect, obtuse hairs. They agree with the female of *microgyna* and differ from those of *nepticula* and *nevadensis* in having the gaster opaque and densely grayish pubescent.

The discovery of these diminutive females not only proves that I was not mistaken in regarding *impexa* as specifically distinct from *F. rufa*, but also indicates that, like *F. difficilis* and *microgyna*, it is a temporary parasite in depauperate colonies of some other species of *Formica*. As a matter of fact, the vial containing the *impexa* workers and females also contained a number of workers of *F. fusca* var. *subaenescens*, which Mr. Morse collected at the

PLATE IV.



Formica Morsei sp. nov.

same time. Although he was under the impression that these black workers might be slaves of the *impexa*, he was not sure that they actually formed part of a mixed colony. It is evident, however, that these species which both happen to be members of our boreal fauna, must have been nesting very near each other.

5. *Camponotus herculeanus ligniperdus* Latreille var. *rubens* var. nov.

Female. Differing from the female of the var. *novaeboracensis* Fitch (= *pictus* Forel) in having all the gastric segments deep red except their posterior margins, which are black.

Male. Indistinguishable from the male of *novaeboracensis.* Worker forms unknown.

Described from the following specimens from the collection of the Museum of Comparative Zoology: Two females from Norway, Maine (S. J. Smith); one female and one male from Bethel, Maine (A. M. Edwards); and four females collected in Michigan by Dr. Clark in 1864.

THE BEDBUG, CIMEX LECTULARIUS[a] *LINNAEUS.*

Pt. II[b]. Critical remarks on its literature, with a history and bibliography of pathogenic relations.

BY ALECANDRE ARSENE GIRAULT, WASHINGTON, D. C.

A full bibliography of this insect, as promised in Part I of this paper, had to be abandoned because of its length. In contemplating its publication, the writer had in mind, mostly, its hoped for usefulness to both entomologists and medical men.

[b] Part I, Psyche XII, 1905 pp. 61-74.

Such a common, and persistently obnoxious insect must necessarily have a very extensive literature, and one that is much scattered, especially since it is a factor directly affecting the social communities of man himself.

In reviewing this body of literature, the writer has been continually impressed by one fact in particular, namely, that in the economic discussion of the bedbug by entomologists, the latter show almost an entire lack of knowledge of its medical literature; and so, conversely, the medical profession in discussing its hygienic, pathological or sanitary relation to man, quite often show great deficiency in their knowledge of its entomological literature. This has, therefore, led to many misleading, erroneous, and loose statements concerning the habits of the pest, made especially, however, in the medical literature and in the writings of zoologists and naturalists. These classes of writings have been found, in nearly all cases, to have been compiled from various unknown sources, both good and bad; the statement of course excepts the literature of experimental medicine. In the latter class of writings, the only fault to be found is the continual use of local or common names instead of the scientific one, such as, for instance, *bug* by the English, *wanze* by the Germans, *punaise* by the French, and so on. This use of vernacular names has thrown doubt on the value of the experiments performed, for the reason that they are entirely too general in their application.

Another point which has very forcibly struck the writer, is the great disproportion between the literature of this insect *en masse*, and the *real* facts now known concerning its habits and life history.

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[a] By request, Dr. Ch. Wardell Stiles has carefully studied the synonomy of this insect, and has decided that *lectularius* is the type of *Cimex* Linnaeus. The insect will therefore retain its original name. *Acanthia*, *Klinophilos*, and *Clinoris* are rejected. Dr. Stiles' note will appear in Proc. Ent. Soc. Washington, VIII, 1906, probably in June of the present year.

The great majority of the accounts are simply re-compilations and appear to have no other purpose than to cover so much space in as rapid a manner as possible, as if the discussion of the bedbug was simply a matter of course, or of duty; to some it actually appeared to be distasteful, doubtless through false modesty. The addition of new facts was exceptional; unfounded statements, however, the rule. So that, taking the whole body of literature, we know more about the bedbug, *theoretically* than we do *actually*, a seeming paradox. The accounts by Southall (1730), De Bomare (1764), DeGeer (1773), Jördens (1801) and Curtis (1835) were good authorities even up to the last two decades, as late as 1890. Southall was probably the source of them all.

A state of affairs of this kind in the history of any insect, especially an important insect, should not be. It is true, that the majority of the accounts published on the bedbug were meant for the information of the general public, and were written in a popular way, but that fact does not excuse the carelessness with which they were compiled, especially since they were written by scientific men. In the remainder of the accounts, which were published as contributions to the knowledge of science, it would at least be expected to find something that really contributed, that were new facts.

In contrast to the great majority of writings on *lectularius*, however, the literature concerning its pathogenic relations is more careful in statement, and less obscure in meaning. This is to be expected from its nature, because experimental evidence is generally presented in the form of a clear statement of facts. But, notwithstanding this, nearly every paper which has been consulted, lacked one essential thing,—the scientific name of the insect in question. Until the species of insect with which experiments are being performed, is definitely known, uncertainty will always attend the results. This is especially true in the case of the bedbug and its near relatives, as just recently pointed out (Girault and Strauss, 1905). Unless the Latin name of the insect was given in the articles on the pathogenic relations, the conclusions drawn from the experiments recorded were always accompanied with doubt as to whether *lectularius*, *columbarius* Jenyns, or one of the other allied species were meant. Any one of the allied species would probably have behaved toward the small mammals used as hosts, as recorded in the experiments. Hence, the confusion.

As the writer has already given several practical illustrations of the poor character of some of the literature of this insect in part I of this paper pp. 61, 72–74) and in a recent paper on host relations just mentioned (Girault and Strauss, 1905), and as he hopes to present elsewhere an abstracted bibliography of the whole, he considers it unnecessary to go into the subject deeper. Suffice it to say, that the few brief criticisms made on the literature of the bedbug, showing as it does needless repetition and speculation. should serve to warn us, in a measure, to be more careful in compiling accounts of our common economic insects, and furthermore, should urge us to make at least some effort to add new facts.

On account of the interest now being shown in the rôle of various insects in the transmission of diseases, and in order to attract the attention of entomologists to the bedbug's rôle in transmission, a brief history of its pathogenic relations follows.

In 1887, the famous Metschnikoff, in an article on certain phases of relapsing fever published in a well-known medical journal of Berlin, made general references to the bedbug as a carrier of diseases. This is believed to be the first time that the idea was definitely mentioned, and Metschnikoff may be held to be the originator of it.

A period of about five years then elapsed before anything more was said about the question, when in 1892 a Dr. Dewévre published in Paris an account of a supposed case of the transmission of tuberculosis, which he discussed at length, and tried to establish. His evidence was quite insufficient, and the whole case did no more than to throw grave suspicions on the bedbug. This article was reprinted in the *Medical Record* of New York, and in the year following it was reviewed in *Insect Life*, a periodical published by the then Division of Entomology, U. S. Department of Agriculture, and in the *American Monthly Microscopical Journal* of Washington. Since then the case has been quoted and reviewed from time to time in medical journals and general treatises on medicine. It was founded on suspicious circumstances only.

In 1895, M. Morau, a Frenchman, published in the *Revue Scientifique* of Paris, an article on the contagiousness of cancer, in which he tried to establish, by means of experiments, that bedbugs carried the causitive agent of that disease. The experiments were entirely negative.

Two years later, articles ascribing to the bedbug means of spreading diseases became more or less common. Dr. George H. F. Nuttall, formerly of Johns Hopkins University, Baltimore, then began his series of important experiments on the rôle of insects in the spread of diseases, which were continued over several years and then, in the year 1900, summarized, together with a critical and historical study of the whole question. The possibility of the transmission of relapsing fever by bedbugs was considered by a Dr. Tictin, with negative experiments, while a Japanese writer, M. Yamagiwa, stated definitely that out of a large number of clinic cases of bubonic plague, one case was caused by the bite of a bedbug.

In the following year, 1898, Dr. Charles F. Craig, then Acting Assistant Surgeon, U. S. Army, quoted the cases of Tictin and Morau, and called attention to the lack of knowledge of the question involved. Experiments on the transmission of anthrax by bedbugs were recorded by M. Joly, with negative results while one of his fellow-country men, Dr. Simond of the Pasteur Institute, stated in a lengthy article on bubonic plague, that the flea and the bedbug were the two "parasites", *a priori*, which were able to assume a rôle in the transmission of that dangerous disease. He thought it probable that the bedbug intervened in the transmission of that disease from man to man.

During 1899, MM. Calmette and Salembeni, in the annals of the Pasteur Institute, wrote of a case of bubonic plague in which the bedbug's bite formed a starting point of the disease. During the same year, Dr. Carmichael, of the U. S. Marine-Hospital Service, said,—"It is suspected that certain insects play a part in the transmission of leprosy, the common housefly, mosquito, and bedbug being the principal carriers of infection." In 1899, Dr. Coplin, of the Jefferson Medical College, Pennsylvania, proved that pure cultures could be inoculated from infected bugs; the infections were those of typhoid fever. After discussing the parts played by household insects in spreading certain diseases, he concludes by saying, "The danger from the bedbug and roach would probably be great in diphtheria and all would share in the possible dissemination of tuberculosis, anthrax, and similar bacterial diseases." But conclusions opposite to this were reached by Muhling in a paper published at Jena about the same time. He concluded that of themselves, bedbugs could not carry contagions, but that their bites would naturally form a *porte d'entrés* for pathogenic bacteria.

With the exception of minor articles, the only other important writing which has been published on bedbugs and their relations to human diseases is that of Dr. Nuttall, mentioned in foregoing. This was first published at Berlin, in 1899, and reprinted the following year in the *Johns Hopkins Hospital Reports*. (Nuttall, 1900.) It critically discussed all the experimental evidence then recorded concerning the transmission by bedbugs of anthrax, bubonic plague mouse-septicemia, chicken-cholera, *Bacillus septicus*, relapsing fever, and tuberculosis. Nuttall concluded that nothing had been positively proven, and his conclusion holds up to the present time.

BIBLIOGRAPHY OF THE PATHOGENIC RELATIONS OF THE BEDBUG.

1887. Metschnikoff, Elias. Ueber dem phagocytenkampf beim rückfalltyphus Archiv f. pathologische anatomie und physiologie, und f. klinische medicine, herausgegeben von Rudolf Virchow (Virchow's Archiv) Berlin, Bd. 109, .pp. 176–192.
General references to transmission of diseases by the bedbug.

1892 a. Dewèvre, (Docteur). Note sur le role des pediculi dans a propagation de l'impétigo. Comptes rendus hebdomadaires des séances et mémoires de la Soc. de biologie. Paris, tome quatrième, nevième séries pp. 232–234.
From Nuttall (1899), p. 32. The reference is evidently a wrong one; tuberculosis and the bedbug are not mentioned.

1892 b. Dewèvre, (Docteur). Note sur la transmissibilité de la tuberculose par la punaise des lits. Revue de médicine, Paris, XII, pp. 291-294.
Account of a case of supposed transmisison, with discussion. "La punaise des lits peut donc jouer quelquefois un rôle assez important dans la propagation de la tuberculose, et nous estimons qu' à l'avenir l'hygiène devra tenir compte de ce facteur noveau en édictant les règles minutieuses de la désinfection." P. 294.

1892. Editors. Bedbugs—. Medical Record, New York XLII, p. 347. Brief summary of Dewèvre (1892 b). Cf. Riley and Howard (1893).

1893. Riley, Charles Valentine and Leland Ossian Howard. An insect transmitter of contagion. Insect Life, U. S. Dep. Agric., Division Ent., Washington, V, p. 210.
Quote Editors (1892).

1894. Alleger, W. W. On the limitation of tuberculosis. Bedbugs as sources of infection. American monthly microscopical journal, Washington,

XV, pp. 295–296.
Briefly gives statements of Dewèvre (1892).

1895. Morau, Henry. Le cancer est contagieux. Revue scientifique, Paris, LV, (III, séries 4), pp. 42–43.
Brief account of experiments with bedbugs.

1896. Galli-Valerio, Bruno. Manuele di parassitologia in tavole sinottiche (vermi e artropodi dell'uomo e degli animali domestici), Milano, pp. 124–125, tavola LXIII.
Listed as *Acanthia lectularia*, with a note to the effect that it is supposed to trasmit tuberculosis.

1897. Editors, (J. H.) Les punaises et les moustiques comme agents de contagion. Revue scientifique, Paris, LIX, (VII, series 4), pp. 110, 112–113.
Review of experiments on the relation of bedbugs to infections in general. Vide Tictin, 1897.

1897. Marpmann, G. Ueber den zusammenhang von pathogenen bakterien. mit fliegen. Centralblatt f. bakteriologie, parasitenkunde und infektionskrankheiten, Jena, Bd. XXII, erste abteilung, pp. 127–132.
Includes theories concerning the relation of bedbugs to pathogenic bacteria of animals and man. Vide Nuttall (1899) p. 23.

1897. Nuttall, George H. F. Zur aufklärung der rolle, welche die insekten bei der verbreitung der pest spielen.—Ueber die empfindlichkeit verstchiedener tiere fur dieselbe. Eine experimentelle studie. Centralblats f. bakteriologie, parasitenkunde und infektionskrankheiten, Jena, Bd XXII, erste abteilung, pp. 91–93, (Versuche mit Wanzen).
Inoculation experiments with *wanzen*, using as hosts small mammals. For general review, vide Nuttall (1900).

1897. Tictin, J. Zur lehre von ruckfalltyphus. Centralblatt f. bakteriologie parasitenkunde und infektionskrankheiten, Jena, Bd. XXI, erste abteiling, pp. 181, 182–186.
"Ueber die Möglichkeit der Uebertragung Ruckfalltyphus durch Wanzen". Relation of bedbugs to "*Febris Recurrens*", with negative experiments.

1897. Yamagiwa, K. Ueber die Bubonenpest. Archiv f. pathologisches anatomie und physiologie, und f. klinisches medicin. Herausgegeben von Rudolf Virchow (Virchow's Archiv), Berlin, Bd. 149, supplementheft, p. 109.
"Ausserdem habe ich bei einem Patienten (Fall LII) in dem Granulationsgewebe des vor der Erkrankung durch dem stich einer Bettwanze entstandenen Gescwurs am linken Unterschenkel, auf * * * * *."

1898. Craig, Charles F. The transmission of disease by certain insects: ticks, bedbugs, ants, etc. Bedbugs and the transmission of disease. New York Medical Journal, New York, LXVIII, pp. 598–599, figs. 3–4.
Quotes Westwood (1840) and Uhler (1884), and gives the substance of the experiments of Titkin (Tictin, 1897) and Morau (1895); figures from Osborn (1896). Lack of knowledge of the question involved.

1898. Joly, Raoul Adrian Paul. Importance du rôle des insectes dans la transmission des maladies infectieuses et parasitaires. Du formal comme insecticide. Bordeaux, thèse, 90 pp.
Includes experiments with bedbugs and anthrax; rabbits used as host. Experiments negative.

1898. Nuttall, George H. F. Zur aufklärung der rolle, welche stechende insekten bei der verbreitung von infektionskrankheiten spielen. Infektionsversuche an mäusen mittels mit milzbrand, huhnercholera und mäuseseptikämie infiezierter wanzen und flohe. Centralblatt f. bacteriologie, parasitenkinde und infektionskrankheiten, Jena, Bd. XXIII, erste abteilung, pp. 625–635.
Important inoculation experiments with *wanzen*. Cf. Nuttall (1900).

1898. Simond, P. L. La propagation de la peste. Annales de l'institut pasteur, Paris, XII, pp. (625–687), 672–673, 677, 687.
"La puce et la punaise sont les deux parasites qu'on peut, *a priori*. soupçonner de jouer un rôle dans la transmission du bacille de la peste." pp. 672–673.
"* * * par certaines particularités de la transmission du rat à l'homme et d'homme à homme; pour ce dernier cas, il est possible que d'autres parasites, enparticulier punaise, interviennent; * * * * *". P. 687.

1899. Abbott, Samuel W. Public hygiene and preventive medicine. The

management and control of infectious diseases. Insects as transmitters of infection. The American year-book of medicine and surgery, Philadelphia, (Gould), pp. 996–997.
A digest of the experiments of Nuttall (1897, 1898). Bedbugs transmit but rarely.

1899. Calmette, A. and A. T. Salimbeni. La peste bubonique. Etude de l'épidémie d'Oporto en 1899, Sérothérapie. Annales de l'institut pasteur, Paris, XIII, p. 883.
"* * * * *, le point de départ de la lésion avait éte une piqûre de punaise." Observations.

1899. Carmichael, D. A. Leprosy in the Hawaiian Islands. The Medical News, New York, LXXIV, p. 95.
Abstract from Public Health Reports, to Supervising Surgeon-General, U. S. Marine-Hospital Service, Dec. 30, 1898.
"It is suspected that certain insects play a part in the transmission of leprosy, the common house fly, mosquito, and bedbug being the principal carriers of the infection."

1899. Coplin, William M. Late. The propagation of diseases by means of insects, with special consideration of the common domestic types. Philadelphia med. journal, Philadelphia III, pp. 1303–1307, 6 text-figs.
Address delivered before the Pennsylvania State Medical Society, Johnstown, Pennsylvania, May 17, 1899.
General account of the part played by household insects in transmitting diseases, with an account of experiments performed with bedbugs roaches, and flies as carriers of bacteria, especially the bacilli of typhoid fever. Figures petri cultures made by contact with infected bugs.
"The danger from the bedbug and roach would probably be great in diptheria, and all would share in the possible dissemination of tuberculosis, anthrax, and similar bacterial diseases." p. 1306.

1899. Mühling, Paul. Die uebertragung von krankheitserregern durch wanze und blutegel. Centralblatt f. bakteriologie, parasitenkunde and infectionskrankheiten, Jena, Bd. XXV, erste abteilung, pp. 703—706.
Original experiments with bedbugs. "Aus allen diesen Thatsachen ergeibt sich also sicher: dass der Wanzenstich an sich nichts zu bedeuten

hat, abgesehen natürlich von der dadurch gesetzten Hautläsion, welche spater eine porte d'entrée fur Bakterien sein kann, dass er aber durch Zerquetschen und Zerreiben des Blutsaugers an der gestochenen Stelle gefährlich werden kann insofern, als Mikrooganismen in den Stichkanal eindringen, welche oberflächlich der Wanze anhaften oder in Darme derselben enthalten sind." p. 705.

1899. Nuttall, George H. F. Die rolle der insekten, arachniden (Ixodes) und myriapoden als trager bei der verbreitung von durch bakterien und thierische parasiten verursachten krankheiten des menschen und der thiere. Eine kritisch-historische studie. Hygienische Rundschau, Berlin, IX, pp. 218–220, 277–278, 279, 280, 281, 283, 394–395, 400.
Historical and experimental evidence of the transmission of diseases by the bedbug; its relation to anthrax, plague, mouse septicema, chicken-cholera, *Bacillus septicus*, relapsing fever, and tuberculosis. Criticism and review of all experiments to date. Vide Nuttall (1900).

1899. Popoff, Leo. Relapsing fever. Twentieth century practice. An international encyclopedia of modern medical science by leading authorities of Europe and America, New York, XVI, infectious diseases, p. 476.
Gives the results of Titkin (Tictin 1897).

1900. Nuttall, George H. F. On the rôle of insects, arachnids and myriapods as carriers in the spread of bacterial and parasitic diseases of man and animals. A critical and historical study. Johns Hopkins Hospital Reports. Baltimore, VIII, pp. 13–14, 17, 18, 20, 22–23, 24–25, 32–33, 39, 120.
About the same as Nuttall (1899).

1900. Packard, Frederick A. Transmission of infectious agents by insects. Progressive medicine, Philadelphia and New York, I, pp. 136–138.
Review and digest of Nuttall (1900) and Coplin (1899).

1900. Riesman, David. The role of insects, arachnids, and myriapods as agents in the spread of diseases due to bacteria or to animal parasites in men and animals. American year-book of medicine and surgery, (Gould), Philadelphia, Medicine, p. 324.
Digest of Nuttall (1899) and Coplin (1899); no proof of the conveyance of tuberculosis has been furnished.

1901. Dawson, Charles F. The dissemination of infectious diseases by insects. American veterinary review, New York, XXV, p. 267.
Quotes the case of Dewèvre (1892).

1901. Homan, George. On the agency of parasitic vermin and other insect pests in the spread of disease. American medicine, Philadelphia, II, pp. 536--537.
Read before the Division of Maritime Hygiene and Quarantine, Third Pan-American Medical Congress, Havana, February, 1901. General article: contains the following very interesting sentences:—"One of the most cosmopolitan and formidable of human parasites remains to be mentioned—Cimex lectularius--and one whose potency for harm in a public health sense has hardly been adequately measured perhaps by reason of its * * nocturnal habits * * * * *.

* * * * * *, but its activity in temperate climates coincides very nearly with the usual maximum prevalence of yellow fever and malarial diseases * * * * * * * *. Its stubborn inhabitancy of human dwellings, however, points significantly to it as at least a coadjutor in the persistence of the first-named disease, where it is endemic, and as an influential agent in the spread of other infections as certain forms of tuberculosis, syphilis, leprosy, carcinoma, and peradventure bubonic plague." p. 537.

1902. Flugge, Carl. Grundriss der hygiene fur studirende und praktische artze, medicinal— und verwaltungsbeamte. Leipzig, funfte, vermehrte und verbesserte auflage, pp. 473, 532, *et al.* Edit. 1, 1891.
Believes that vermin in general spread *Febris recurrens*.

1902 a. Howard, Leland Ossian. How insects affect health in rural districts Farmer's Bull, No. 155, U. S. Dep. Agric. Washington, p. 18, fig. 15 Yearbook U. S. Dep. Agric., Washington, 1901, p. 190, fig. 19.
Contains the following sentence, in referring to the transmission of diseases by insects, "Even the common bedbug is strongly suspected in this connection." Figures adult.

1902 c. Howard, Leland Ossian. Mosquitoes. How they live; how they carry disease; how they are classified; how they may be destroyed. New York, p. 65.
Grassi (1900) excludes the bedbug and others from being possible car-

riers of malaria, on the strength of their wide distribution. Grassi has not been seen, and is not listed.

1903. Jennings, William Ernest. A manual of plague, London, p. 32. Bugs may be carriers of plague.

1904. Bergey, D. H. The principles of hygiene. A practical manual for students, physicians, and health-officers. Philadelphia, New York and London, edit. 2, revised, pp. 378, 390, 391, 394, 400, 412.
The bedbug is believed to be instrumental in disseminating the parasite of relapsing fever; and other diseases.

1904. Herzog, Maximilian. The plague: bacteriology, morbid anatomy, and histopothology, including a consideration of insects as plague carriers, Bull No. 23, (U. S.) Dep. Interior, Bureau Govt. Laboratories, Boil Laboratory, Manila, pp. 75, 83.
States Nuttall's (1897) results; bacteriological examination of five bedbugs taken from a room in which a plague patient slept.

1904. Titus, Edward Sharpe Gaige and Frederick Charles Pratt. Catalogue of the exhibit of economic entomology at the Louisiana purchase exposition, St. Louis, Mo., 1904. Bull. No. 47, U. S. Dep. Agric., Bureau Ent., Washington, p. 120.
Listed under the heading, *Insects which may spread disease.*

1905. Bolduan, Charles and Mary E. Goodwin. A clinical and bacteriological study of the communicability of cerebro-spinal meningitis and the probable source of contagion. Medical news, New York, LXXXVII. p. 1226.
"The vermin theory of infection also presupposes the presence of the meningococcus in the peripheral blood of the patients. * * * * * * * * * *. Even when present it does not appear to be so abundant that fleas or bedbugs would be likely to ingest one very often."

1905. Girault, Alecandrè Arsène and John Frank Strauss. The bedbug, *Clinocoris lectularius* (Linnaeus), and the fowl-bug, *Clinocoris columbarius* (Jenyns:) host relations. Psyche, Cambridge, Mass., XII, pp. 117–120.
Adults and larvae attacked in confinement recently dead, and living, mice. Brief discussion of host relations. Cf. Laidy, 1877, Proc. Acad.

Nat. Sciences, Philadelphia, XXIX, p. 284.

1905. Harrington, Charles. The relation of insects to human diseases. Bedbugs. A manual of practical hygiene for students, physicians, and medical officers. Edit. 3, revised, Philadelphia and New York, pp. 640–641. Dewèvre's (1892) case cited. Nuttall's (1899) experiments negative. Muhling (1899) agrees that no danger of infection is to be apprehended from the bites alone.

1905. Radcliffe-Crocker, Henry. Animal parasites of the skin. Diseases of the skin, their description, pathology, diagnosis, and treatment, with special reference to the skin eruptions of children. Edit. 3, revised, Philadelphia, II, pp. 1357, 1386.

By H. Radcliffe Crocker, Edit. 1, 1888, London and Philadelphia, pp. 708–709. Edit. 2, 1893, London, p. 877. Edit. 2, 1893, Philadelphia, p. 925.

Brief description of the bite with treatment.

1905. Simpson, W. J. A treatise on plague, dealing with the historical, epidemiological, clinical, thereapeutic, and preventive aspects of the disease. Cambridge, p. 222.

Gives the case of Calmette and Salimbeni (1899).

1905. Walsh, James J. (Anon). Disease and dirt and the tramp. The Independent, New York, LVIII, pp. 680–681.

Lengthy editorial on probable transmission of cerebro-spinal meningitis by insect blood parasites. Reference to the transmission of relapsing fever by the bedbug.

For reference to a few, apparently, unimportant papers not listed or seen, consult Tictin, 1897.

LITERATURE REFERRED TO IN PARTS I & II

1730. Southall, John. A treatise of buggs: showing when and how they were first brought into England. How they are brought into and infect houses. Their nature, several foods, times and manner of spawning and propogating in this climate. Their great increase accounted for, by proof of the numbers each pair produce in a season. Etc., Etc., London, v xii + 44 pp.; frontispiece of 16 figures. Hamburg, 1737; Berlin 1742; new edit. 1793.

A very full account of *lectularius*, monographic in nature, which strangely has been followed by many to date. A copper-plate is given of 16 duplicate figures of the eggs, larvae at weekly periods of growth, European and American specimens, all said to be of natural size, and of an enlarged adult; figures nearly recognizable. Recommends winter treatment, simple furniture, and avoidance of soft woods, second-hand furniture, and washerwomen. The account of course is full of errors, due to the times. Southall states that he could find no works on *lectularius* previous to his. No references are given.

1764. De Bomare, Valmont. La punaise de lit, *Cimex domesticus*. Dictionnaire raisonné universal d'histoire naturelle; contenant l'histoire des animaux, des végetaux et des minéraux, et celle *etc.*, *etc.* Paris, tome quatrième, pp. 519-522. An old, but important, account.

1773. De Geer, Carl. Punaise des lits. Memoires pour servir à l'histoire des insectes, Stockholm, III, pp. 296–305, pl. 17, figs. 9–15.

Good account. Synonomy; origin, description, habits, feeding-habit and effect of bite; remedial measures with experiments; predaceous enemies; recommendations; length of life without food. Cf. Jordens (1801) p. 33. Latreille (1807) and Westwood (1840), gives wrong reference.

1801. Jordens, Johann Heinrich. Die Bettwanze. Entomologie und helminthologie des menschlichen korpers, oder beschreibung und abbildung der bewohner und feinde desselben unter den insekten und wurmern. Hof, erster band, pp. v, 32–40, tab. I, figs. 16–25.

Description of the egg, young and adult; external sexual characters; distribution and occurrence; effect of bite; De Geer's observations on the effect of the attack on two persons; enemies; remedies; figures with details. A very important account, with apparently complete bibliography to date.

1807. Latreille, Pierre André. Genera crustaceorum et insectorum secundum ordinem naturalem in familias disposita, iconibus exemplisque plurimis explicata. Parisiis et Argentorati, tomus tertius, p. 137. Paris, 1807, pp. 36–37.

Defines *Cimex* and fixes *lectularius* as type.

1833. Dufour, Léon. Recherches anatomiques et physiologiques sur les Hemiptères, accompagnées de considérations relatives a l' histoire naturelle et a la classification de ses insectes. Mémoires des Savants etranger a l' Acad. de Science, Paris, IV, pp. 184 ff. Separate, Paris 1833.
From various authors. Vide Landois (1869) p. 230. Not seen. Much quoted.

1835. Curtis, John. *Cimex lectularius.* The House—or Bed-bug. British Entomology, London, XII, p. 569, pl. 569, 9 figs.
Description and history of distribution; remedial measures. Good, colored figure of adult, with details.

1839. Jenyns, Leonard. On three undescribed species of the genus *Cimex* closely allied to the common bed-bug. Annals and Mag. Natural Hist., London, III. pp. 241-244, pl. V, figs. 1-3.
(? Isis, 1844, XI, p. 830.)
Original descriptions of *Cimex columbarius*, *hirundinis*, and *pipistrelli*, with characteristics of each and a synoptic table of the species including *lectularius.* Hagen (1862, *Bibliotheca Entomologica*, Leipzig) gives wrong reference.

1840. Westwood, John Obadiah. An introduction to the modern classification of insects; founded on the natural habits and corresponding *etc.* London, II, pp. 465, 474-477, fig. 121, 1 and 4. Synopsis, p. 120.
Restricts *Cimex* to one species, *lectularius.* Good account, mostly historical. Figures poorly the adult and larva.

1855. Fitch, Asa. The Chinch Bug. Rep. on the noxious, beneficial, and other insects of the State of New York, in Trans. New York State Agric. Soc., XV, p. 523. Separate, 1856, Albany, p. 291.
Mentions the change in application of the word *chinche* from *lectularius* to *Blissus leucopterus* Say.

1868. Landois, Leonard. Anatomie der Bettwanze (*Cimex lectularius* L.) mi Beruchtigung verwandter Hemipterengeschlechter. Zeitschr, f. wissenschaftliche zoologie (Siebold und Kolliker), Leipzig, Band XVIII, pp 206-224, tafeln XI-XII, figs. 1-14.
Brief history; names; anatomy of the digestive organs; of the salivary glands; and of the odoriferous glands, with good figures. Continued in Landois (1869).

1869. Landois, Leonard. Antomie der Bettwanze (*Cimex lectularius* L.) mi-beriichsichtigung verwandter Hemipterengeschlechter. Zeitschr. f. wissenschaftliche zoologie (Siebold und Kölliker), Leipzig, Band XIX, pp. 206–233, tafeln XVIII–XIX, figs. 1–25.

A continuation and conclusion of Landois (1868). Anatomy of the organs of respiration; of the fat bodies; of the male and female reproductive organs, including a description of the ripe egg; of the nervous system; of the body segments, wing covers and legs; and of the muscles. Also a list of 25 titles, and four references to figures.

1884. Uhler, Philip Reese. Standard Nat. History, Boston, II, p. 285, fig. 328. Riverside Nat. History, Boston and New York, II, p. 285, fig. 328. Brief account, with figure. Osborn (1896) gives wrong reference, which is copied by Craig (1898).

1885. Lintner, Joseph Albert. The bed-bug infesting a library. Second Rep. on the injurious and other insects of the state of New York, Albany, pp. 16–18, 152.

Quotes correspondent; house found infested, the insects hiding in numbers in books and files of papers. Brief history and habits, with remedies. On p. 152, a note in regard to other applications of its common names (Vide Fitch, 1855.)

1886a. D'Herculais, Jules Kunckel. La punaise de lit et ses appareils odoriferants.—Des glandes abdominales dorsale de la larve et de la nymphe; des glandes thoraciques sternales de l'adulte. Comptes rendus de l'Academie des Sciences, Paris, CIII, pp. 81–84. Separate, Paris, 5 July, 1886, 4 pp.

Preliminary description of the oderiferous glands of the larva and adult. Cf. D'Herculais (1886b).

1886b. Idem. La punaise de lit et ses appareils odoriférants -Changement de situation et de forme de ces appareils aux differents ages de l'insecte. Comptes rendus he bdomadaires des seances et memoires de la Sociéte de biologie, Paris, tome troisieme, huitieme serie, pp. 375–377.

"En resume,la punaise de lit possede depuis son eclosion, *a l'etat de larva et de nymphe. trois glandes, odoriferiques abdominales dorsales* qui disparaissent lors de la derniere mue et sont remplacées, *a l' etat adulte, par un appareil glandulaire metathoracique sternal.* La presénce de cet appareil est un critérium qui permet de démontrer que ce Cimex est arrivé au terme son évolution." p. 377.

1886c. Idem. Recherches sur les glandes odorifiques des insectes hémiptères, et particulièrement sur celles de la punaise de lit. Mécanisme de la secretion. Valeur dans la classification; Association française pour l'advancement des sciences, Congrès de Nancy, XV, pp. 528–532, 2 figs. Separate, Paris, 1886, 5 pp. 2 figs.

Description and anatomy of the odoriferous glands of larva and adult, with illustrations.

1887. Riley, Charles Valentine. Poisonous insects. Reference Handbk. of the Medical Sciences, New York, Edit. I, V, p. 752. Separate, New York, 1887, p. 752.

Brief account, Cf. Osborn (1902).

1893. Butler, Edward Albert. The Bed-bug. Our household insects, London, pp. 273–303, pl. VI, text-figs. 85–101. Knowledge, London, 1890, XIII, V, new series, pp. 209, 225, 251, 275, and cf. Butler (1894). Reviewed, Westminster Budget, Oct. 6, 1893, Westminster Gazette, Oct. 10, 1893.

Good account, including etymology and origin of common and scientific names, anatomy, general description of the stages, remedies, enemies, ancient uses and insects mistaken for; with good figures of adult female and anatomical details.

1896a. Lugger, Otto. The Bed-bug (Acanthia lectularia Linn.) Bull. No. 48, Minnesota Agric. Exp. Station,St. Anthony Park, pp. 222–227, figs. 159–165.

Good popular account; allied species.

1896b. Idem. Second annual Rep. Ent. of the state experiment station of the University of Minnesota, to the governor, for the year 1896. Delano, pp. 196–201, figs. 159–165.

Same as Lugger (1896a).

1896a. Marlatt, Charles Lester. The Bedbug. (*Cimex lectularius* Linn.) Bull. No. 4, new series, U. S. Dep. Agric. Division Ent., Washington, pp. 32–38, figs. 7–9. Revised Edit., 1902.

Very good general account of what is known to date of habits and life history. Number of molts first stated. Excellent figures.

1896. Osborn, Herbert. The common bed-bug. (*Acanthia lectularia* Linn.) Bull. No. 5, new series, U. S. Dep. Agric., Division Ent., Washington, pp. 12, 157–160, 162, 163, figs. 88–89, 92b. Cf. pp. 286–287.
Good history and account, with remedies. Figures nymph, adult, and antennae; compares with descriptions, the more common allied species, quoting Jenyns' (1839) descriptions. Host relation.

1901. Howard, Leland Ossian. Life-history of the bedbug. The Insect Book, New York, pp. 289–290, figs. 178, 179.
Good popular account, with figures of young larva and adult.

1902. Osborn, Herbert. Insects, parasitic. A reference hand-book of the medical sciences, embracing the entire range of scientific and practical medicine, and allied sciences, by various authors. New York, new, revised edit., V, MDCCCCII, pp. 155–156, figs. 2865–2867.
General account; figures copied. cf. Riley (1887).

ERRATA et CORRIGENDA, PART I.

Page 61, 2nd line of title, *lectularia* read *lectularius*.
Ibidem, insert parentheses about *Linnaeus*.
71, 3rd. footnote, *Titkin* read *Tickin*
2nd. paragraph, insert quotation marks about *bacilli*.
3rd. paragraph, *contagious* read *infectious*.
72, 3rd. paragraph, *Cimex* read *Clinocoris*.

Acknowledgements.

The writer wishes to acknowledge the kindness respectively of Dr. L. O. Howard, Chief, and of Miss Mabel Colcord, Librarian, of the Bureau of Entomology, U. S. Department. of Agriculture. Also his indebtedness to Dr. James J. Walsh of New York City, Dr. Edward-Louis Troussart of Paris, Dr. Edward A. Butler of London, and to Mr. George W. Kirkaldy of Honolulu, for past kindnesses in connection with the preparation of this and other papers.

DESCRIPTIONS OF TWO NEW DIPTERA OF THE FAMILY DOLICHOPODIDAE.

BY CHARLES W. JOHNSON.

Leucostola slossonae n. sp.

Face very narrow, linear, whitish, oral portion black, front and vertex green, shining, bristles large; occiput green, with a row of small black bristles above near the orbits and a shorter parallel row behind, the lower half bearing long, silvery, white hairs; antennae black, third joint conical, length about equal to the first and second taken together. Thorax and scutellum a shining metallic green, with long black bristles, the four on the scutellum widely separated; plurae green, covered with a whitish pollen, prostigma yellow. Abdomen green, shining, with short black hairs, base of the second, third, fourth and fifth segments a dark metallic bronze, sides of the second, third and fourth segments, with a spot of whitish pollen at the posterior angle, sixth segment a metallic blue-black, hypopygium dark green, lamellae brown, very long and filiform. Legs yellow, the upper side of the front and tips of the posterior femora, tips of the front and middle tibiae, tips of the posterior metatarsi and the entire tarsi black, coxae greenish, with a thin whitish bloom and white hair on the front and middle pairs, each of the middle coxae bears a prominent black spine, end of the front metatarsi dilated and forming a knob-like projection below. Wings with a slight brownish tinge, tegulae yellow, cilia white, halteres yellow. Length 6.5 mm. Type in the New England collection of the Boston Society of Natural History.

One specimen collected on Mt. Washington, N. H., by Miss Annie T. Slosson, during the summer of 1905. The absence of hairs on the first joint of the antennae and short transverse second joint, bars this species from the genus *Argyra*. On the other hand, the long lamellae, coxal spines, and dilated front metatarsi makes its position under *Leucostola* only tentative, until more material is obtained.

Argyra robusta n. sp.

Face and front black, covered with a dull, grayish pollen, face broad with an irregular transverse ridge, depressed above with a slight tubercle below the base of the antennae, mouth parts projecting considerable below the eyes, the large, broad palpi with a distinct covering of grayish pollen, occiput grayish, the rows of black bristles above prominent, with white hairs below, antennae black, the third joint as broad as long, the first about as long as the second and third taken together. Thorax a purplish bronze, covered with a thin grayish dust forming quite distinct dorsal lines, plurae black with a light gray pollen. Abdomen also purplish bronze, with a thin grayish polen more dense at the base of the segments, giving a banded appearance. Legs yellow, the coxae, base of the femora and tips of the tarsi black, the coxae dusted with a whitish bloom, the hairs black. Wings broad, hyaline with a slight tinge of brown, tegulae yellow, the tip black, with white cilia. Halteres yellow. Length, 5.5 mm. Type in the author's collection.

One specimen from Vaudreuil Co., Quebec, July 10, 1907, collected by Mr. G. Chagnon. I have hesitated for a long time from describing this species from a single ♀, hoping that the ♂ would turn up. It is, however, so very distinct from any of the described forms, that there can be no likely chance of confusion.

Argyra aldrichi Johnson.

Since describing this species (Psyche, X. p. 18, 1904) I have had the opportunity of examining another specimen collected by Dr. W. E. Britton, at New Haven, Connecticut, June 8, 1904.

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—LXV.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Eois rotundopennata Packard. The moths differ a little from Packard's description as noted by me (Proc. U. S. Nat. Mus., Vol. XXVII, p. 902-903, 1904.)

Egg. Elliptical, flattened above and below, sunken concave toward the depressed end, no truncation, the micropylar end full and rounded. Reticulations large, irregularly hexagonal, raised, sharp and smooth, smaller in the indentation. Cell areas reticular shagreened. Dead leaf brown, the whole of the antemicropylar flattening blackish brown, a less prominent shade in the indentation; size .6 x .45 x .35 mm. Laid more or less in rows obliquely overlapping, the brown end down, its color caused by the brown mucilage with which the eggs are glued on.

Stage I. Head rounded, free, dark brownish black, not shining. Body long and slender, curled in S shape, the segments finely annulate, elongated; dark brown; a narrow, straight, distinct white dorsal line, a broader but less distinct substigmatal one; joints ten to thirteen paler and with a white subdorsal line added. Thoracic feet blackish; tubercles small, brown; setae short, capitate, obscure.

Stage II. Head squarish bilobed, the lobes slightly conically produced before, dull brown-black with short, scale-like white setae; width .4 mm. Body small, slender, elongate, finely annulate, subventral ridge narrowly prominent, subdentate by the annulets. Dark vinous brown, almost black. A narrow white dorsal line, traces of a subdorsal one at the ends and a more distinct line on the subventral fold, all dotted by the annulets. In dorsal view the segments are cuneiformly widened posteriorly. Thoracic feet black, abdominal ones brown, the anal pair diluted anteriorly. Tubercles and setæ minute, the latter scale-like.

Stage III. Head highly bilobed, the lobes subconic; brown-black with short white setae; width .6 mm. Body moderately elongate, the segments cuneiform.

the posterior edges almost wing-margined on joints five to nine, finely annulate. Dark blackish brown, dorsal line linear, whitish; traces of waved subdorsal; subventer with white streaks on the fold, the lower subventral area nearly black. Skin black, granular; setae short, white, capitate.

Stage IV. Head highly bilobed, the lobes separated by a deep notch but rounded, a strong depression at the apex of clypeus; red brown, mottled and dotted with dark brown; width .9 mm. Body moderate, large for the head, flattened, the segments strongly widened posteriorly, cuneiform in dorsal view, joints eight and nine most widened, the thorax and joints ten to thirteen contracted, all rather finely annulate. Dark blackish brown, slightly variegated in lighter; a pale subdorsal streak on joints ten to thirteen; edge of subventral fold streaked in yellowish white, especially on joints seven, eight, and nine; venter and feet nearly black with a few whitish dots in rows. Skin minutely granular; tubercles obsolete; setae short, pale, swollen, sack-like.

Eggs June 10, a few apparently mature larvae in August, but most of them remained very small and probably normally hibernate. They were fed on *Polygonum*. Larvae from Kaslo, British Columbia.

TWO NEW SPECIES OF TELENOMUS.

BY A. ARSENE GIRAULT, WASHINGTON, D. C.

1. Telenomus quaintancei species novem.

Female.—

Shining black; length, 0.60 mm. trochanters, knees, distal tips of tibiae, and tarsi, brownish-yellow; basal and distal joints of tarsi darker, the latter sometimes nearly black.

Head slightly wider than mesothorax, much wider than prothorax, from dorsal aspect twice as wide as thick (cephalo-caudad), shagreened; face to cephalic ocellus glabrous, excepting the portions bordering the inner margins of the eyes which are hairy; head triangulate, cephalic aspect hairy; eyes hairy and very dark red, ocelli inconspicuous, reddish, the lateral ocelli close to, but not touching, the margin of the eye.

Thorax rather stout, slightly longer than abdomen, sculpture similar to that of the head, the dorsum with rather dense whitish pubescence. Mesothorax flattened dorsad, with a deep conspicuous smooth femoral furrow on its side. Scutellum smooth, hairy, striate at outer edges.

Abdomen smooth, polished, first and second segments, at base, strongly, longitudinally striate, the striations of the second segment not present near the lateral margin of that segment; second segment by far the largest, one-third wider than long; hairs sparse, whitish, in lateral rows at incisions; anal segment truncate. Abdomen depressed.

Wings hyaline, venation yellowish, the marginal vein more than half the length of the shaft of the stigmal; postmarginal vein sub-equal in length to the marginal and submarginal veins combined, or slightly shorter. Shaft of the stigma thick.

Antennae 11-jointed, uniformly pubescent, black; scape at basal constriction and at tip, and the tip of the pedicel, pale. Antennae more gradually clavate than usual, the club, however, distinct.

Scape long, subclavate, constricted at basal one-fourth and narrowed somewhat at tip; longer than the four joints following. Pedicel oval, much longer and thicker than the first funicle joint. Funicle joints 1, 2, and 3 moniliform, slightly longer than wide, equal, about half the length of the pedicel; 4, wider. Club 5-jointed, the basal joint somewhat rounded, but much wider and slightly longer than joint 4 of the funicle, wider than the scape, and narrower than joint 2 of the club; club joints 2, 3 and 4 equal, 2 slightly smaller, all nearly twice as large as joint 1 of the club, quadrate; the distal joint, or 5, conic, its base slightly narrower than joint 4 of the club, but wider than the pedicel, and about equal to the pedicel in length, though much stouter. Antennae shorter than the body. From six specimens.

Male.—

The same. Length, 0.68 mm., legs and antennae lighter in color; body more slender. Abdomen oval. Mandibles dark brown, tridentate at tip.

Antennae 12-jointed, filiform, the pubescence stiffer. Scape long, cylindrical, curved, more pale at the tip than in the female, nearly as long as the next five joints combined. Pedicel small, rounded, subcuneate. Joint 1 of the funicle longer than the pedicel by one-half, ovate; funicle joints 2 and 3 sub-equal, oval, twice as long as the pedicel and about one-third longer than the first funicle joint; funicle joints 4 and 1 subequal; joints 5, 6, 7, 8 and 9 of funicle equal, subequal to funicle joint 4, but slightly smaller. Club joint acutely conical, twice longer than the preceding joint, or joint 9 of the funicle. Joints of the funicle very slightly pedicellate. Antennae about equal in length to the body. From ten specimens.

Sixteen specimens; ten males, six females.

Female very near to *Telenomus graptae* Howard, female, but the males of the two species are quite distinct. In the female of *quaintancei,* the legs are much darker than those of *graptae*, and the antennae are wholly black, and have a much better defined club. The male differs from the male of *graptae,* by having black antennae and legs, and in the relative lengths of the club and joint 2 of the funicle.

Bred from the eggs of *Sanninoidea exitiosa* Say, on peach, Odenton, Maryland, September 1st to 8th, 1905, in connection with Deciduous Fruit-insect Investigations, Bureau of Entomology, U. S. Department of Agriculture. Apparently common.

The species is respectfully dedicated to Professor A. L. Quaintance.

Type:—No. 9098, United States National Museum.

2. **Telenomus perplexus** species novem.

Female.—

Shining black, length, 1.18 mm.; legs, excepting anterior coxae, yellowish brown; pedicel concolorous with scape, darker basally.

Head slightly wider than thorax, polished, shagreened along the inner margins of the eyes and on vertex. Eyes and ocelli normal, the former naked.

Thorax slightly longer than the abdomen; mesothorax minutely punctate, pubescent.

Abdomen short, subcuneate (dorsal aspect), the anal segment truncate; the second segment slightly longer than wide; first and second segments, at base, strongly, longitudinally striate; remaining segments polished. Wings hyaline, venation pale yellowish.

Antennae 11-jointed. Scape long, longer than the next three joints combined. Pedicel equal to, or slightly shorter than, the first funicle joint, but thicker; ovate. Joint 1 of funicle cylindrical, much longer than the following joints, twice the length of joint 3 of the funicle; funicle joints 2, 3 and 4 subequal, 3 and 4 equal, 2 slightly longer, all moniliform. Club 5-jointed, its basal joint transverse, about equal in length to joint 4 of the funicle, or slightly longer; club joints 2, 3 and 4 subequal, varying slightly in width, 3 the widest, all much wider than the other antennal joints; the distal antennal joint, or club joint 5, conic, acute, about as long as each of the three preceding joints of the club.

From two specimens.

Male.—

The same. Length, 1.15 mm. Antennae 12-jointed. Scape paler yellow; antennal joints 2, 3 and 4 with some yellow.

Scape short, about as long as pedicel and first funicle joint combined. Pedicel short, subcuneate, about half the length of the first funicle joint. The latter cylindrical, equal to, or slightly longer than, joint 2 of the funicle; funicle joint 3 thicker and shorter; funicle joints 4, 5, 6, 7, 8 and 9 moniliform, equal, much shorter than joint 3 of funicle, and less than half as long as funicle joint. 1. The club pointed cylindrical, nearly twice longer than the joints immediately preceding, and about equal to joint 3 of the funicle in length.

From one specimen.

Three specimens; 1 male, 2 females.

Bred from the eggs of *Brochymena* species on Currant, received from Miss May Beattie, Zanesville, Ohio, July 20th, 1905, in connection with Deciduous Fruit-insect Investigations, Bureau of Entomology, United States Department of Agriculture.

Type:—No. 9039, United States National Museum.

NEW LEPIDOPTERA FROM VENEZULA.

BY ANDREW GRAY WEEKS, BOSTON, MASS.

Habitat: Suapure, Venezuela. Expanse: 1.10 inches.

Head and palpi above black, below tawny. Thorax above black, below black with gray hairs. Abdomen above black, below brown with a white dash at thorax junction. Antennae black. Club black above, below tawny. Legs black near body, turning to tawny toward tips.

Upper side of fore wing black. Near apex, in subcostal area, is a small white dot. Below this, skipping one interspace, is a series of five interspacial white spots running downwards towards centre of inner margin, the first two small, the third very large, the fourth small and fifth a small dot in lowest submedian interspace.

Upper side of hind wing black. A broad and very prominent white band runs from centre of inner margin towards upper angle, extending across one-half the wing only, stopping near end of discoidal space. Inner margin slightly dusted with gray scales.

Marginal fringes of ground color, turning to white at anal angle.

Under side of fore wing the same as upper surface except that the spots are more closely connected and the ground color is brownish.

Under side of hind wing the same as upper surface except that the prominent band extends completely across the wing from a point near the upper angle on costa to centre of inner margin and of unvarying width. This band is creamy white.

Variations: My small series of specimens shows no variations except that the two small subcostal spots are sometimes wanting and the lowest dot, also, on fore wing.

This species was not found in collections here, nor in the Godman collection, British Museum, etc.

Taken in January, 1900.

Pamphila verdanta sp. nov.

Habitat: Suapure, Venezuela. Expanse: 1.15 inches.

Head, thorax and abdomen above, dark brown with hairs of a greenish tinge; below, greenish with white hairs. Antennae, black. Club above black, below tawny. Legs greenish at base, tawny towards tip.

Upper side of fore wing dark brown. Immediate basal area dark tawny, the nervures and nervules showing distinctly black. Costa dark tawny nearly to apex. In apical area are three subcostal tawny spots, and below these, two more somewhat nearer hind margin. Below these last two is a series of three large interspacial tawny spots extending downwards towards centre of inner margin, but stopping at lower submedian nervule. The lowest of these three spots is well concaved on hind marginal side. Hind marginal fringe tawny.

Upper side of hind wing dark brown. Across the centre of the wing is a broad band of tawny, starting near upper angle and stopping near central portion of inner margin. The basal area has some tawny hairs. Hind marginal fringe tawny.

The costal area of lower side of fore wing is a tawny green, also the apical area, extending downwards to a point at lower angle. The inner marginal area up to discoidal space is nearly black. The band of lighter spots of upper surface is distinctly repeated with slight dashes of similar shade in hind marginal interspaces.

Under side of hind wing tawny green. Close to juncture with thorax is a white spot. The band of upper surface is repeated but is pure white and extends nearer or fully to the costa just above angle. Hind marginal interspaces dashed with tawny suffusing upwards somewhat near anal angle. The anal angle is dusted with dark brown scales.

Taken in March, 1900.

Pamphila mengeli sp. nov.

Habitat: Suapure, Venezuela. Expanse: 1.10 inches.

Head, thorax, abdomen and antennae dark brown above, nearly white beneath. Club above dark brown, beneath dark brown tipped with brick color. Legs nearly white.

Upper side of fore wing dark brown. Basal area slightly dusted with golden scales. Near the apex are two subcostal white dots, very minute. Below these in first submedian interspace near end of discoidal space is a larger white dot, and below it in next lower interspace, are two white dots in a line

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To replace corresponding pages in April-June number

NEW LEPIDOPTERA FROM VENEZUELA.

BY ANDREW GRAY WEEKS, BOSTON, MASS.

Carystus Ambrosei sp. nov.

Habitat: Suapure, Venezuela. Expanse: 1.10 inches.

Head and palpi above black, below tawny. Thorax above black, below black with gray hairs. Abdomen above black, below brown with a white dash at thorax junction. Antennae black. Club black above, below tawny. Legs black near body, turning to tawny toward tips.

Upper side of fore wing black. Near apex, in subcostal area, is a small white dot. Below this, skipping one interspace, is a series of five interspacial white spots running downwards towards centre of inner margin, the first two small, the third very large, the fourth small and fifth a small dot in lowest submedian interspace.

Upper side of hind wing black. A broad and very prominent white band runs from centre of inner margin towards upper angle, extending across one-half the wing only, stopping near end of discoidal space. Inner margin slightly dusted with gray scales.

Marginal fringes of ground color, turning to white at anal angle.

Under side of fore wing the same as upper surface except that the spots are more closely connected and the ground color is brownish.

Under side of hind wing the same as upper surface except that the prominent band extends completely across the wing from a point near the upper angle on costa to centre of inner margin and of unvarying width. This band is creamy white.

Variations: My small series of specimens shows no variations except that the two small subcostal spots are sometimes wanting and the lowest dot, also, on fore wing.

This species was not found in collections here, nor in the Godman collection, British Museum, etc.

Taken in January, 1900.

Pamphila verdanta sp. nov.

Habitat: Suapure, Venezuela. Expanse 1.15 inches.

Head, thorax and abdomen above, dark brown with hairs of a greenish tinge: below, greenish with white hairs. Antennae, black. Club above black, below tawny. Legs greenish at base, tawny towards tip.

Upper side of fore wing dark brown. Immediate basal area dark tawny, the nervures and nervules showing distinctly black. Costa dark tawny nearly to apex. In apical area are three subcostal tawny spots, and below these, two more somewhat nearer hind margin. Below these last two is a series of three large interspacial tawny spots extending downwards towards centre of inner margin, but stopping at lower submedian nervule. The lowest of these three spots is well concaved on hind marginal side. Hind marginal fringe tawny.

Upper side of hind wing dark brown. Across the centre of the wing is a broad band of tawny, starting near upper angle and stopping near central portion of inner margin. The basal area has some tawny hairs. Hind marginal fringe tawny.

The costal area of lower side of fore wing is a tawny green, also the apical area, extending downwards to a point at lower angle. The inner marginal area up to discoidal space is nearly black. The band of lighter spots of upper surface is distinctly repeated with slight dashes of similar shade in hind marginal interspaces.

Under side of hind wing tawny green. Close to juncture with thorax is a white spot. The band of upper surface is repeated but is pure white and extends nearer or fully to the costa just above angle. Hind marginal interspaces dashed with tawny suffusing upwards somewhat near anal angle. The anal angle is dusted with dark brown scales.

Taken in March, 1900.

Pamphila mengeli sp. nov.

Habitat: Suapure, Venezuela. Expanse: 1.10 inches.

Head, thorax, abdomen and antennae dark brown above, nearly white beneath. Club above dark brown, beneath dark brown tipped with brick color. Legs nearly white.

Upper side of fore wing dark brown. Basal area slightly dusted with golden scales. Near the apex are two subcostal white dots, very minute. Below these in first submedian interspace near end of discoidal space is a larger white dot, and below it in next lower interspace, are two white dots in a line parallel to hind margin. A black dash extends downwards towards centre of inner margin from the end of discoidal space. Marginal fringe very light brown.

Upper side of hind wing dark brown. A series of four indistinct interspacial white spots extend from near upper angle across the wing towards anal angle. Marginal fringe very light brown.

Under side of fore wing light brown, the lower half, especially towards the base, dark brown. The white dots of upper surface are repeated, the two lower ones more prominent, and in interspace below these is a dusting of light scales. Marginal fringe of ground color. Tips of nervules and nervures touched with black. Nervures and nervules of lighter color than ground color.

Under side of hind wing light brown. The nervures and nervules distinctly lighter. The light spots of upper surface are joined, forming a line rather than a series of spots and extending upwards nearer to costa. Within this line and at centre of wing area is a light dot of similar color. The marginal fringe and border is the same as on fore wing.

This species was found in the Godman collection unnamed, but was not in the British Museum or other large collections.

Taken in November, 1899.

Pamphila winslowi sp. nov.

Habitat: Suapure, Venezuela. Expanse: 1.15 inches.

Head, thorax and abdomen above, tawny with a greenish tinge; below, nearly white. Antennae black. Club black above, below bright tawny with brown towards tip. Legs bright tawny.

Upper side of fore wing dark brown. The entire basal area is bright tawny, extending along costa to near apex, and also along inner margin to near hind margin. The brown ground color juts inwards towards base at end of discoidal space and also in the two lower submedian interspaces. A black dash crosses the wing from end of discoidal space downwards to lower submedian nervule. At central point of the wing the bright tawny is golden color. The coloring is the same as in many species of pamphila, such as P. mystic Scudd., P. brettus Boisd., P. sylvanus Esp. and many others.

Upper side of hind wing dark brown. Discoidal space bright tawny suffusing into interspace towards hind margin and also into the next upper and next lower interspaces. The entire inner marginal area is dusted with golden scales and hairs.

The hind margins of both wings have a dark thread and a fringe of tawny, darker on fore wing than on hind wing.

Under side of fore wing bright tawny. The tawny markings of upper surface show in a somewhat lighter shade. The basal area below costa is nearly black and below it the inner marginal area is mouse color. Hind margin edged with a dark brown thread. Fringe slightly darker than ground color.

Under side of hind wing very bright tawny approaching a golden yellow. The tawny markings of upper surface are barely noticeable. Towards anal angle, the ground color darkens in a slight degree. Hind margin edged with a dark brown thread. Fringe slightly darker than ground color.

Taken in November and December, 1899.

Erycides nakawara sp. nov.

Habitat: Suapure, Venezuela. Expanse: 2.25 inches.

Head above, black with blue dots encircling the eyes and three thread-like lines of blue crossing from eye to eye; below white. Antennae black. Thorax above, black with four bands of blue running parallel to one another from shoulder to abdomen; below, black with white bands. Abdomen above, nearly white with a black band running down its centre from thorax to tip, circled with black at base of each segment; below, black with four white bands parallel to one another running from thorax to tip. Upper joints of legs blue, lower joints black.

Upper side of fore wing black. Immediate basal area brilliant blue. Nervures and nervules black. Beyond this a broad black band heavily dashed with blue in two lower interspaces. Running across the wing diagonally from costa nearly to lower angle is a broad band of semitransparent white. Between this and apex, well below the costa, is a similar white band covering two interspaces only. In the apical area is a patch of similar size with a white dot on costa. Well within the hind margin is a line of blue scalings running from rear apex to lower angle.

Upper side of hind wing black. From the base run three prominent blue dashes, the lower one following close to inner margin and extending nearly to anal angle, the next covering the discoidal space and a little beyond, the third one runs parallel to these and is of similar extent. The first and third are covered with white or very light blue hairs, the central or second one having scaling only. The hind margin is well dentated towards anal angle, the interspaces touched with white. Well within it is a line of blue scalings well broken by the nervules, a continuation of the same markings of fore wing. Near upper angle betwixt this line and the outer one of the three prominent dashes, is a dash of blue scales, starting well below the costa and running a quarter inch downwards towards anal angle.

Under side of fore wing black but not as rich as upper surface. General markings the same. Basal blue area of upper surface is represented only by blue at base of costa and a blue diagonal dash beyond. The inner marginal area is dark mouse color except towards lower angle. The dashes of blue noted in the two lower interspaces of upper surface are wanting.

Under side of hind wing black. The appearance of the wing is quite different from upper surface as the prominent dashes of brilliant blue are quite altered. There are three bands, one starting at costa at base and extending downwards until by a slight inward curve it strikes lowest submedian nervule about midway to lower angle; the next band runs downwards from costa, practically the same in area and extent as the first, ending at centre of wing area at the end of discoidal space; the third band represents the hind marginal blue line of upper surface, but is much more prominent. Inner margin edged with brilliant blue.

This species is very close to E. distans Herr. Schaff. and also E. pygmaleon Hew. The group is open to much interesting future work for those who locate in its region.

Thymele pervivax Hubn., var. nov. **aleanderi.**

Habitat: Suapure, Venezuela. Expanse: 1.75 inches.

Head and thorax above brilliant green; below, brilliant green with some brown and white hairs. Abdomen above, dark brown; below light brown. Antennae, black. Legs above, dark brown; below, lighter with greenish hairs near body.

Upper side of fore wing, a rich dark brown. The basal area is heavily dusted with brilliant green scales. Fringe of hind margin becomes whitish towards lower angle.

Upper side of hind wing the same.

Under side of fore wing dark brown with golden lustre. Basal area dusted with lustrous green scales as on upper surface. Inner marginal area very light brown.

Under side of hind wing the same as upper surface. Taken in January, 1900. This is practically indentical with T. pervivax, Hubn. excepting that pervivax has a very prominent semitransparent band crossing the fore wing. The specimens in hand show no indication of such a band except in one instance where I noticed a slight dot. It would be unsafe to create a new species and the advisability of naming a variety is doubtful. There is a specimen in the Godman collection un-named.

Thanaos parkeri sp. nov.

Habitat: Suapure, Venezuela. Expanse: 1.60 inches.

Head, thorax and abdomen above, very dark brown. Antennae black with white annulations at base of each joint. Club black above; tawny brown beneath, and approaching white towards base. Legs nearly black.

Upper side of fore wing very dark brown with slight grayish dustings. Near the base is a slight suggestion of gray dusting running from costa towards inner margin scarcely perceptible. The interspaces beyond, in centre of wing and the centre of discoidal space show a slight gray dusting. Outside of this in a line from costa downwards to lower submedian nervule, is a slightly prominent irregular band of gray dusting, broad at costa but diminishing and disappearing towards lower submedian nervule. In apical area outside of this band are four subcostal semitransparent white dots. Hind margin edged with a dark thread, and the hind marginal area has a series of interspacial grayish dashes from costa down to inner margin, well within the margin, and hardly noticeable.

Upper side of hind wing dark brown. The only marking is a suggestion of light brown dashes in interspaces running from upper angle to a point just above anal angle on inner margin. Hind margin edged with a dark thread. Fringe is generous and near upper angle is edged with white.

Under side of fore wing dead dark brown. The gray dustings of upper surface do not show. The series of interspacial dashes or dustings within the hind margin are fairly prominent. The subcostal white dots are repeated. The hind margin has a dark thread and the fringe shows light hairs in interspaces.

Under side of hind wing dead dark brown. The line of interspacial light dashes of upper surface, running from upper angle downward are repeated and more clearly defined.

This species is closely allied to N. tatius Edw., N. juvenalis Fabr. and that group, and a detailed and identifiable description is almost impossible. One specimen was found unnamed in the Godman collection; also one specimen unnamed in the British Museum, taken in Malto Grosso, Brazil.

Taken in December, 1900.

Nisoniades plummertini sp. nov.

Habitat; Suapure, Venezuela. Expanse .95 inch.

Head, antennae, thorax, abdomen and legs above, very dark brown; below, lighter brown.

Upper side of fore wing dark brown. Across centre of wing from centre of costa a darker band runs downwards through discoidal space to inner margin. A similar band, but slightly broader, starts from costa and runs down to inner margin at a point near lower angle, following the contour of hind margin. On the inner edge of this band are four subcostal white dots and two more below them in the first and second submedian interspaces. There is a very slight dot also at the end of the discoidal space. The interspaces at edge of hind margin are slightly darker than ground color.

Upper side of hind wing the same as fore wing, the bands being continued to inner margin. The dots are, however, wanting.

Under side of fore wing the same as upper surface except that color is lighter and deader.

Under side of hind wing the same as upper surface except that color is lighter and deader.

Taken in November, 1900.

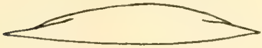
A specimen was found in the Godman collection unnamed. It is very close to N. hayhursti Edw.

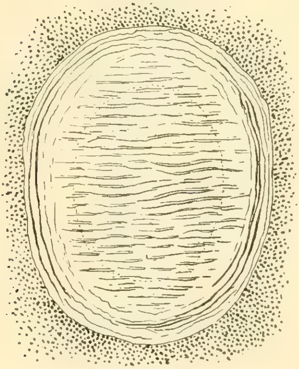
COCOONS AND YOUNG OF CONIOPTERYX VICINA.

BY J. H. EMERTON, BOSTON, MASS.

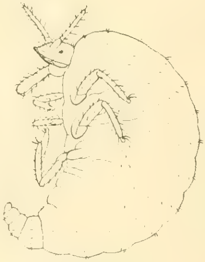
While hunting for spiders under leaves on the ground at Allston, a suburb of Boston, in November, I found the cocoons of this neuropterous insect attached to oak leaves and resembling the egg cocoons of small spiders like Micaria and Castaneira. The cocoons were white and had fine parallel wrinkles across the upper surface, in this differing from spider cocoons, which are usually smooth. In nearly every case the cocoons were on small broken pieces of leaves of last season's growth. The under side of the cocoon is thin and attached to the leaf by its whole surface. The upper side is formed by a flat ring sometimes thickened on the inner edge and a transversely wrinkled cover which is not attached to the inner edge of the ring but beyond it near the outer border of the cocoon, as shown in the section. The mature insect tears a hole

CROSS SECTION OF COCOON

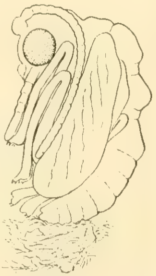




COCOON ATTACHED TO BARK



Winter larva as taken from cocoon



Pupa with larva skin adhering to lower end.

in the upper side large enough to crawl through, and leaves the pupa skin half way out.

The larva is flattened sidewise like an amphipod crustacean and lies on its side in the cocoon. It is motionless when removed, even after several days in a warm room. It resembles closely the larva of *C. psociformis* Curtis described and figured by Schlectendal in the proceedings of the Verein fur Naturkunde of Zwickau, Saxony, in 1881. The head resembles it closely and the mandibles are short and pointed as in psociformis, but the antennae and legs are much shorter than in that species. The whole body is roughened with fine rounded elevations and each segment is crossed by a single row of short hairs.

Schlectendal found his larvæ in winter under loose bark of oak trees at Halle in cocoons resembling those of spiders and was as much astonished as I was at the discovery. He, however, concluded that the cocoons were really those of spiders and that the larvae had eaten the eggs. The cocoons differ in structure from any spider cocoons with which I am acquainted and it seems more probable that they are made by the larvae themselves when about to hibernate.

A larva in a cocoon found November 9 and kept in the house in a tight bottle matured and came out of the cocoon January 30. Cocoons collected January 31 and then containing larvæ had pupae in them March 1, and the mature insects came out March 12 to April 1.

THE MAXILLA IN RHYNCHOPHOROUS COLEOPTERA.

To the Editor of Psyche:

In Vol. XI. of Psyche, in the paper by Miss McClenahan on the development of the rostrum in Rynchophorus Coleoptera, there is used a nomenclature of parts of the maxilla that is probably in part incorrect. As I am responsible for this usage, I wish to make this explanation. Miss McClenahan's study was a developmental one and did not concern itself with the tips of the maxilla. Her time was limited to the very little that is available for work on an undergraduate thesis. I was busy with other investigations, and when the need of names for these maxillary sclerites arose, I told her to follow some authority, and to concentrate her study upon the developmental problem. The papers she used were mostly borrowed, and I do not now remember the source of the nomenclature copied. Since her paper was published both Miss McClenahan and myself have received a number of letters, making inquiry as to the reasons for her apparent interpretation of homologies. Looking into the matter now, it appears that what is called the galea of the maxilla in her paper, should be called the palpus; the galea having disappeared through fusion with the lacinia in the Ryncophorous Coleoptera, although still preserved separately in some other coleopterous larvae. In this conclusion Miss McClenahan now concurs.

JAMES G. NEEDHAM.

A NOTE FROM STANFORD UNIVERSITY.

The entomological collections and laboratories at Stanford University suffered practically no injury from the recent earthquake in California. The Stanford buildings which were wrecked were the great Memorial arch, the famous church, and three large new buildings in course of erection (library, gymnasium and museum). University work will begin again on August 23, the regular date for the opening of the next college year.

(Signed) VERNON L. KELLOGG.

PSYCHE

A JOURNAL OF ENTOMOLOGY

ESTABLISHED IN 1874

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EXCHANGES.

[Exchange notices (not over five lines) inserted free for subscribers. Notices will be inserted in the order in which they are received, and those at the top of the column will be removed only when it is necessary to make room for new ones at the bottom.]

WANTED—Eggs, larvae or pupae of grasshoppers, dragon-flies, beetles, bugs, etc. Will give tropical butterflies in exchange. Denton Bros., Wellesley, Mass.

WANTED—Material for the study of the hybrid or polymorphic butterflies of the genus *Basilarchia*, including larvae or pupae of *arthemis* or *astyanax*, imagos of *proserpina* or *arthechippus* or any specimens showing unusual characters. Liberal exchange. Specimens retained will be deposited in Museum of Comparative Zoology. W. L. W. Field, Milton, Mass.

LEPIDOPTERA—For exchange, fertile eggs of *Hemileuca maia*. Alfred C. Sampson, Sharon, Mass.

I have a few specimens of *C. calleta* and *cinctus* to exchange for rare *Sphingidae* or Pupae of same. W. T. Buxton, 17 Walter St., Somerville, Mass.

WANTED—Ova, larvae or pupae of *Limenitis ursula* and *arthemis*. Will give cash or exchange. H. H. Newcomb, 35 Court St., Boston, Mass.

Will collect Diptera, Hymenoptera, Hemiptera and Coleoptera. Would like in exchange, quantities of named or unnamed Buprestidae, Scarabaeidae, Cerambycidae and Chrysomelidae. Please write immediately to G. Chagnon, P. O. Box 186, Montreal, Canada.

Correspondence desired regarding Rhopalocera of North and South America, especially Argynnis, Papilio, Morpho, Caligo. Exchange or otherwise. T. H. Shepherd, 15 Hope View, Carr Lane, Shipley, Yorks., England.

EASTERN MASS. MOTHS WANTED in exchange for same. Also, reliable colored sketches of larvæ of same. C. V. Blackburn, 101 Pine St., Woburn, Mass.

Am willing to make contracts to collect for the season, with private collectors, museums colleges, or any public institution for insects of any order or group desired, either in large or small series. Duplicates of all orders for sale from Colorado, New Mexico, and Arizona. Correspondence solicited. Ernest J. Oslar, 4535 Raleigh St. Alcott P. O., Denver, Colorado.

WANTED—Records of captures of Connecticut insects—especially the rarer species—for the preparation of a State list. Orthoptera and Hymenoptera records desired at once. W. E. Britton, State Entomologist, New Haven, Conn.

CICINDELIDAE of the world wanted. Good exchange in all families of Coleoptera offered. H. F. Wickham, Iowa City, Iowa. U. S. A.

HIPPODAMIA—Live individuals and large masses for variation study desired. Insects collected to order in exchange. The following species especially wanted—H. moesta, 12-maculata and sinuata. R. H. Johnson, Station for Experimental Evolution, Cold Spring Harbor, N. Y.

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PSYCHE

A REVIEW OF THE NORTH AMERICAN SPECIES OF NOTIOPHILUS.

BY H. C. FALL, PASADENA, CAL.

Mr. Hayward's recent article (Psyche, Oct., 1905) on the secondary sexual characters of Notiophilus, recalls a short study of this genus made by the writer some seven or eight years ago, which, having progressed to the point of preparing a preliminary table of species, was dropped for other work. Since the publication of Mr. Hayward's note, the old data have been resurrected, some further investigation made, and the results are offered as of possible interest to students of our Coleoptera.

In completing the present review I have been very greatly aided by Mr. Frederick Blanchard, who has not only made a most thorough study of the Le Conte Collection, fixing the status of the earlier types of this author, but also an examination of the collections of Melsheimer, Harris and Ziegler, where were found undoubtedly authentic exponents of Say's *semistriatus*, a species which Le Conte himself failed to properly interpret. The results of Mr. Blanchard's observations are embodied in the synonymy which follows, and to him belongs almost the entire credit for this very considerable portion of the work. While no effort has been made to obtain material from many sources, special series have been sent by Messrs. Leng, Wickham, Knaus and Blaisdell, to all of whom my sincere thanks are due.

The genus Notiophilus is widely dispersed throughout the North Temperate Zone and occurs in almost every portion of our territory, though evincing a somewhat marked preference for hilly and mountainous regions. Although of small size, the peculiar and pleasing form and sculpture of these insects has made them favorites with collectors, yet it is a fact that aside from *aeneus*, *semiopacus* and perhaps *sylvaticus*,—all strongly marked forms— our native Notiophili are sure to be found more or less confused in nearly all collections.

At the time of my original investigation it was noted that in all species of the genus the males have one setigerous puncture each side and the females two;* but I do not recall having observed the dilation of the middle tarsi in the males of certain species to which Mr. Hayward alludes, and which was originally announced by C. G. Thomson.† This modification is at best very feeble, and in view of its gradational character, quite too slight to be used for specific separation. To illustrate: Hayward divides our species into two groups, the first containing *sylvaticus, aquaticus, hardyi* (=*aquaticus*) and *nitens*, in all of which the basal joint of the middle tarsi is dilated; the second containing *aeneus, semiopacus, semistriatus* (=*novemstriatus*) and sibiricus (*semistriatus*) ‡ having this joint "simple as in the females." This division is quite correct, and when we compare the opposite extremes—*sylvaticus* and *aeneus*—the difference is very obvious, but if we compare the adjacent extremes of the two series—say *nitens* and *novemstriatus*—the difference is so slight that a trifling individual variation might easily reverse their positions. Wherever there is any dilation of the basal joint of the middle tarsus, there is a similar and better marked modification of the front tarsus; in fact, with the possible exception of *aeneus*, where it is scarcely detectable, the males of all species have the first three joints a little dilated or more triangular in form than in the female, the difference being relatively slight in the species of Hayward's second group. In all species of the genus, without exception, the first three joints of the front tarsi are more or less squamose beneath in the male, as is also the basal, and sometimes the second joint of the middle tarsi; the squamules here being present in the apical half or less of the joints in those species with the first joint undilated. In the reference above quoted, Thomson describes as new *bigeminus*, and states that it differs from the common European species—*aquaticus, palustris* and *biguttatus*—in its simple non-spongiose middle tarsi of the male, and in the securiform last joint of the labial palpi, especially in the male. The entire correctness of Thomson's statement may, I think, fairly be questioned, as I much doubt if there is any species of Notiophilus in which the middle tarsi are normally absolutely

---

*This character fails in rare instances. I have seen a male *semistriatus* with two anal punctures, and a female of *aquaticus* with only one puncture each side.

† Bull. Ent. Soc. France, 1883, p. CXII.

‡ *Obscurus* Fall was omitted by Mr. Hayward, being unknown to him; it is virtually the same as *nitens* in this respect. The parentheses are mine.

devoid of squamules. Mr. Blanchard has recently observed (*in litt*) that the palpi are more or less dilated in the males of certain of our species. An examination shows that this is true of all our species, the dilation being as a rule slight, but in *semistriatus* quite strongly marked, and sufficient to at once separate this species from all others in our fauna.

Of the not very numerous characters useful in distinguishing our species, it may be well to briefly discuss two or three of the more important before using them in the following table. In all of the species the front is broadly longitudinally grooved at the sides, the intervening space being marked with narrower grooves or striae which differ in number and fineness in such a fashion as to enable us to divide our species into three groups. The striae are not infrequently more or less irregular, so that the exact number is not always easy to determine, but with a very little experience there is rarely any difficulty in determining to which group a given specimen belongs.

These three sections may be termed from the number of frontal striae the 5-striate, 7-striate, and 12-striate groups. Of these the 5-striate series is much the most numerous, containing eight of the eleven North American forms, including all that are found east of the Mississippi River, or for that matter east of the Rocky Mountains, if we except a form of *nitens* occurring in Texas. To the second group belong *nitens* and *obscurus*, two closely allied species, which are intermediate between the first and third groups in other characters besides the number of frontal striae. To the 12-striate group belongs only *semiopacus*. The striae here are very fine and seem to vary in number from eleven to thirteen.

Another character which I have found to be remarkably constant is the number of annulate setigerous punctures ("foveae") near the apex of the elytra. This character is an especially useful one, inasmuch as it permits of separating at once and with certainty, forms which are without careful attention easily confused. In all the species there is a setigerous puncture near the apex and just within the deeply impressed apical portion of the seventh stria. In the greater number of species there is also a second puncture immediately in front of this, and distant from it as a rule somewhat less than its distance from the suture, but in three species—*semistriatus*, *aquaticus* and *borealis*—the apical puncture alone is present. The other characters used in the following table are sufficiently clear or will be made so in the remarks under the various species.

In several instances our species are mutually very closely related, depending for their specific standing on an assemblage of minor characters which, while probably quite sufficient for their establishment, render their tabulation somewhat unsatisfactory because of their gradational nature. Absolute characters are present only in the two extremes of our series—*aeneus* and *semiopacus*.

TABLE OF SPECIES.

Front 5-striate between the broad lateral grooves.

Legs and antennae entirely pale; head much wider than the prothorax, the sides of the latter deeply sinuate posteriorly..................1 *aeneus*.

(Legs dark or with the tibiae alone paler, antennae pale at base only.)

Elytra each with one apical annulate puncture.

Form generally stouter, sides of prothorax more strongly sinuate behind; elytral striae complete, the inner ones, however, faintly impressed at apex; tibiae more or less pale; last two joints of maxillary and terminal joint of labial palpi dark, the latter quite broadly dilated and truncate in the male....................................2 *semistriatus*.

Form less stout, sides of prothorax less sinuate behind, inner elytral striae nearly or quite effaced at apex; palpi dark except at extreme base, the terminal joint of the labial palpi but slightly modified in the male.

Less elongate, prothorax more transverse, elytra parallel, more strongly punctured and less bronzed, tibiae usually dark, sometimes pale...3 *aquaticus*.

More elongate, prothorax less transverse, elytra a little narrowed anteriorly; less strongly punctured and more bronzed; tibiae always dark...4 *borealis*.

Elytra each with two apical annulate punctures.

Elytra usually entirely black bronzed, rarely with pale apical stripe.

Second discal stria of the elytra more remote from the fifth than from the sutural stria, striae becoming rapidly obsolete behind the middle; tibiae dark......................................5 *simulator*.

Second discal stria of the elytra less remote from the fifth than from the sutural stria; striae less fine and in part entire; tibiae paler..6 *novemstriatus*.

Elytra with a broad and entire yellow lateral vitta occupying the lateral interstriae.

Form more elongate, prothorax less transverse and more narrowed

behind . . . . 7 *nemoralis*.
Form less elongate, prothorax more transverse, sides straighter and less convergent behind . . . . 8 *sylvaticus*.

Front 7-striate.
Prothorax rather strongly narrowed posteriorly, interstriae of elytra feebly or scarcely alutaceous, a single dorsal puncture . . . . 9 *obscurus*.
Prothorax less narrowed posteriorly, interstriae of elytra distinctly alutaceous, dorsal punctures usually two in number . . . . 10 *nitens*.

Front about 12-striate; lateral interstriae and sutural interspace opaque, dorsal punctures usually three, rarely two or four . . . . 11 *semiopacus*.

1. N. *aeneus* Hbst.

Very distinct from all our remaining species and at once recognizable by the pale legs and antennae. It represents an entreme among our species in its larger head, stouter antennae, deeply sinuate sides, prominent hind angles and broadly impunctate disk of the prothorax, and in the less unequal elytral interspaces, thereby approaching the usual type of striation in the Carabidae. The labrum is here distinctly emarginate at apex, but scarcely at all so in our other species. The dilation of the male tarsi is at a minimum, being scarcely detectable, and the squamules of the middle tarsi are few in number.

Aeneus is a common species in the Northern States and Canada from New England to Lake Superior and Illinois, and extends as far south as North Carolina. (Blanchard).

2. N. *semistriatus* Say.

In its rather strongly narrowed and sinuate sides of the prothorax, and the relatively narrow second elytral interspace, this species approaches *aeneus* more closely than does any other, and forms a natural transition to those which follow. It is, as a rule, a little more robust than *aeneus*, and differs from it and all other species of the 5-striate group except *sylvaticus* and *nemoralis* in its more distinctly impressed and more complete elytral striae, which though fine are all quite evident at apex. In color it is black, moderately bronzed, surface polished throughout, basal four joints of antennae, and tibiae in great part, pale. Terminal joint of palpi (especially the labial) quite strongly dilated and truncate. I have seen several examples in which the discal annulate puncture of the elytra is wanting, a condition not yet observed in any other species.

Semistriatus is widely dispersed, occurring from New England to New Mexico The following localities are known to me: Massachusetts; Staten Island, New York (Leng.); Pennsylvania; New Jersey; North Carolina; Ohio; Illinois; Iowa; Ottawa; Canada; Manitoba; Kansas; Veta Pass, Colorado (Schwarz); Breckinridge, Col., 9600-10,000 feet (Wickham); New Mexico (Snow); Cloudcroft, New Mexico (Knaus.)

The species here regarded as *semistriatus* agrees well in size and general character with Say's description, and is the one so understood by Harris, Melsheimer and Ziegler. Moreover it is the only species with which Say could have confused his *porrectus* (*aeneus* Hbst.), which he originally described as "var B" of *semistriatus*. The *semistriatus* of Le Conte and Crotch was Le Conte's *novemstriatus*, a much smaller and very different looking species which is common in the eastern United States. The true *semistriatus* was described as *confusus* by Le Conte, who afterward wrongly placed it as a synonym of the East Siberian *sibiricus*, with which he also confused his own *punctatus*.

3. *N. aquaticus* Linn.

Very similar to *semistriatus*, and as a rule a little smaller and less robust, though frequently not at all so. The prothorax is a little less narrowed behind, the sides less strongly sinuate, the elytral striae less impressed and less coarsely punctured than in *semistriatus*; the discal striae are moreover almost completely effaced at apex, while they are more or less distinctly traceable in *semistriatus*. The tibiae are entirely dark in the great majority of specimens but are occasionally more or less pale, and the elytra have rarely a more or less distinct pale apical vitta. The terminal joints of palpi are perhaps a little more evidently dilated in the male than usual, but the dilation never approaches in degree that exhibited by males of *semistriatus*. *Aquaticus* is also nearly related to *borealis* and *simulator*, the former separable however by its more elongate form, and the latter by the two apical annulate apical punctures of the elytra. Further differences will be given under these species.

After a very careful study of available material and of the literature of the subject, there seems to be no other course than to unite *punctatus* Lec. and *hardyi* Putz. with *aquaticus* Linn., which occurs commonly throughout Europe and Northern Asia. The *punctatus* of Le Conte was described from Lake Superior. In the types, and also in a series from Hudson's Bay Territory in the Le Conte collection, the tibiae are reddish and the elytra have a pale apical vitta, but on comparison with a typical Newfoundland specimen of *hardyi*, sent to Le-Conte by Putzeys, Mr. Blanchard assures me that he has not the slightest doubt of their identity. This most obvious variation in the specimens in our fauna, viz—the color of the tibiae and elytral apex, are noted by Putzeys in his description of *hardyi*, and are exactly paralleled in European specimens of *aquaticus*; in fact the described variations of *aquaticus* in Europe are much greater than that existing between a series sent me by Reitter, and our native specimens.

Kirby many years ago recorded *aquaticus* from British America, and Sahlberg has more recently thus identified a specimen from the Alaskan coast of Behring Strait. Le Conte pronounced Kirby's reference erroneous, but there is ample reason for saying that the correctness of Le Conte's views in this genus is not above suspicion. The introduction of *aquaticus* into the supplement of the Henshaw list is based on Sahlberg's record, which may have been correct, though I suspect that the species in question was really *borealis*, a species which is closely related to *aquaticus*, and which is known to me from Alaska.

In our fauna *aquaticus* is known to range from Labrador through northern New England and Canada to Lake Superior, Hudson Bay, Manitoba, Montana, and in the higher parts of the Rocky mountains as far south as New Mexico. It is thus seen to be a distinctly more northern species than *semistriatus*, which occupies the intervening territory to the south. Its occurrence at Tyngsboro in northeastern Massachusetts and only a few hundred feet above sea level is quite exceptional according to Mr. Blanchard, who says—"In February, 1870, about fifty specimens of *N. aquaticus* were picked up from a frozen temporary pool in a grassy field; some were partly frozen into the ice, others were crawling about on the surface. Of these I have only three ♀'s left, all others having been distributed as *hardyi*, and none have since been taken here."

The following specific localities are known to me: Labrador (Strait of Belle Isle—Sherman); Newfoundland (*hardyi* in Le-Conte Coll., Bay of Islands—Leng.); New Hampshire (Mt. Washington and Pack Monadnock—Blanchard); Massachusetts (Tyngsboro and summit of Mt. Watatic—Blanchard); Wisconsin (Bayfield—Wickham); Lake Superior and Hudson Bay Territory (Le Conte Coll.); Montana (Kalispell—Wickham and the writer); Colorado (Argentine Pass and Veta Pass—Schwarz, Mountains southwest of Montrose, 9-10,000 feet, Cochelopa Pass, Durango 5500-7000 feet—Hayward); New Mexico (Beulah—8,000 feet, Las Vegas Range—11,000 feet—Cockerell).

4. *N. borealis* Harris.

Very closely allied to the preceding species, the chief differences being as follows: The color is more brightly bronzed than in our native specimens of *aquaticus*, the general form more elongate, the prothorax distinctly less transverse and slightly more narrowed posteriorly, the elytra more elongate and more oval, widest behind the middle, narrowing a little anteriorly, the humeri in consequence less strongly rounded; elytral striae a little more finely punctate and as a rule less completely effaced at apex. The tibiae are apparently always dark; the basal joint of the antennae, except very rarely, is entirely dark; joints 2-4 pale beneath, usually dark above, but sometimes only slightly so. In *aquaticus* the first four joints are pale beneath.

This species is the most truly boreal or alpine in distribution of any in our fauna. It has been taken by Mr. Blanchard on or near the treeless summits of Mts. Washington and Lafayette in the White Mountains of New Hampshire, and by Mr. Leng on Mt. Marcy, the highest peak of the Adirondacks, the beetles being obtained, writes Mr. Leng, "by sifting the mosses that flourish in sheltered places among the otherwise bare rocks of the summit." Specimens closely in accord with these have been sent me by Dr. Blaisdell, who took them at Nome, Alaska. I have, under *aquaticus*, expressed the suspicion that the Alaskan specimens recorded by Sahlberg as *aquaticus* were really the present species.

The name *borealis* is adopted from the Harris Correspondence, published by Scudder in 1869. It was used by Dr. Harris in a letter to Dr. LeConte (Jan. 23, 1849) for a specimen taken in the White Mountains by Mr. Tuckerman. Mr. Blanchard writes that "this species is at present represented in the Harris collection by a single female specimen without name, numbered 1680, and referred to by number only in the Ms. catalogue as having been collected by Mr. Tuckerman at the White Mountains in 1838. The specimen now bears the label *hardyi*," which has of course, been attached comparatively recently. There can be no doubt whatever that this specimen is the true *borealis* of the "Correspondence," and though the brief allusions therein do not fairly constitute a description, still, as no subsequent description has been written and no synonymy is involved, I have chosen to quote Harris as the author of the species.

5. *N. simulator*, n. sp.

This species greatly resembles *aquaticus* but is always separable by the two apical annulate punctures. In addition, the size is a little smaller, the elytral striae decidedly finer, becoming effaced at a greater distance from the apex, the dorsal puncture a little more basal in position; the sides of the prothorax a little straighter and very feebly sinuate posteriorly. The palpi and antennae are colored as in *aquaticus;* the tibiae are black in all specimens seen.

Length 4.4—4.65 mm.

Four specimens, all ♀'s, have been sent by Mr. Wickham. They bear labels as follows: Mullan, Montana; Leavenworth Valley and Silver Plume, 9000-11000 feet, Colorado; Houston, Texas. There is a specimen, also a ♀, in Dr. Blaisdell's collection from Coeur d'Alene, Idaho, probably also collected by Wickham.

Simulator is the nearest approach in our fauna to the Siberian *sibiricus* of which there is a specimen in the LeConte collection labeled "Ajan," and sent by Motschulsky himself. This specimen, writes Mr. Blanchard, "is a little larger than *simulator*, prothorax a little more narrowed at base and sinuate each side behind, the elytra with humeri more arcuate each side to meet the narrowed prothorax, elytral striae more produced behind and more coarsely punctate except at base, the elytra apparently a little more elongate." These differences, it will be seen, are precisely those which separate *simulator* from *aquaticus*, and were it not for the two apical punctures in *sibiricus* it could not possibly be separated from *aquaticus*.

6. *N. novemstriatus* Lec.

Our smallest species, and withal the commonest in the eastern United States. It is easily recognized by its small size, rather strongly bronzed surface lustre, very broad second elytral interspace and consequent crowding of the lateral striae, and two apical annulate punctures. The inner ones of the lateral striae are more or less completely obliterated before the apex, the apical portion of the first of these (the second stria) however, remaining as a short isolated furrow. Two or three of the striae before the deeply impressed seventh are always nearly or quite entire. The four basal joints of the antennae, and the tibiae, are always pale, the palpi dark except at base. There is occasionally a pale apical elytral vitta, more often seen in specimens from the Southern States. In all the preceding species the surface of the elytra is polished throughout, there being only the faintest indication of alutaceous sculpture at the extreme apex. In the present species the apex is always distinctly alutaceous for a short distance, and this sculpture exists in all the following species, becoming strongly marked in the 7-striate and 12-striate groups.

Specimens of this species with the front normally striate were early referred by LeConte to *semistriatus* Say, while others of the same species (and afterwards so recognized by LeConte) in which the frontal striae were broken up or divided as they frequently are in some degree, served as the types of *novemstriatus*. The name is thus seen to be an unfortunate one, but must stand. Harris observed that in this species the dorsal and apical punctures are placed in shallow foveae and therefore gave it the name *quadrifoveatus* in MS. These foveae are, however, often feeble or obsolete and Harris' name would therefore be but little better than LeConte's.

Novenstriatus inhabits most portions of our territory from northern New England to Florida, and westward to New Mexico. The following localities are known to me: New Hampshire, Massachusetts, Rhode Island, New York, Pennsylvania, New Jersey, District of Columbia, Maryland, Virginia, North Carolina, South Carolina, Ohio, Iowa, Florida (Pensacola), Alabama (Mobile), Lousiana (Vowell's Mills—Leng.), Nebraska, Kansas, Texas, New Mexico (Cloudcroft, Viereck).

7. N. nemoralis n. sp.

This and the following species differ conspicuously from all others of the 5-striate group by the entire or subentire broad lateral yellow stripe of the elytra. Both forms have hitherto passed as *sylvaticus,* but the present one, which is known to me only from Northern New England is quite readily separable from the true *sylvaticus* of the North Pacific coast fauna by the somewhat larger head, slightly less transverse prothorax, which is distinctly more narrowed behind and more coarsely punctate beneath, and by the slightly longer more oval elytra, which are almost always a little more deeply striate. It may be seen at once that this species bears the same relation to *sylvaticus* that *borealis* does to *aequaticus*. It is of course quite possible that *nemoralis* and *sylvaticus* are merely geographical races of one species, but the fact that no intermediate form, nor even a specimen of either has ever been recorded from the three thousand miles of intervening territory makes it probable that they are now completely isolated and distinct, whatever their origin. *Nemoralis* is in fact more nearly related to the European *biguttatus* than to *sylvaticus*, and I was once tempted to consider them identical. A careful comparison shows that biguttatus is a somewhat stouter insect, the prothorax a trifle more transverse and the elytra less elongate, with the second or broad interspace a little wider. According to Putzey's description—the only one at hand—the yellow apical spot frequently reaches the middle of the elytra, but no mention is made of its ever reaching the base, nor does it do so in any of the specimens seen by me.

Nemoralis is more restricted in habitat than any other species known to me, and the greater number of specimens seen are labeled "White Mts., N. H." Other localities—none of them very far from the White Mountains— are Moosilauke, N. H., and Rangely, Me. (Blanchard), and Camels Hump, Vt. (Sprague). Specimens were obtained, writes Mr. Blanchard, by "sifting moss, etc. in the upper woods (White Mts.), and the Rangely specimen occurred several hundred feet above the lakes * * * also sifting in woods."

8. *N. sylvaticus* Esch.

The differential characters between this and the preceding species have already been set forth, and there can scarcely be any excuse for confusing it with any other. Some examples of *semiopacus* show a complete lateral vitta, which is, however, of a paler, duller yellow and quite opaque, not to mention the differently striate front and numerous dorsal punctures by which the latter may always be readily separated.

This species occurs rather commonly in the Coast belt from southern Mendocino County, in California, through Oregon, Washington, Vancouver and British Columbia to Sitka and Kenai in Alaska. It occurs at both low and high altitudes, at least toward the southern portion of its range, having been taken by Dr Van Dyke "high up on Mt. Rainer, much above 5000 ft., equivalent to an altitude of 8000 or 9000 feet in the southern Sierras."

9. *N. obscurus* Fall.

As indicated in the synoptic table, the present species and *nitens* may be distinguished from our other species by the front having seven striae between the broad lateral grooves. In my original description of *obscurus* the front was described as 8-10 striate, the lateral grooves in this case being counted. In addition to the number of the frontal striae, these two species occupy an intermediate position between the 5-striate and 12-striate groups in several other particulars. In *sylvaticus* a tendency becomes manifest toward a reduction of the punctuation of the under surface of the prothorax. In *obscurus* this is much more marked, the episterna becoming in most specimens very sparsely punctate or almost smooth, a condition which is the rule in *nitens* and *semiopacus*. In *obscurus* the sides of the prothorax are rather sharply rounded or subangulate a short distance behind the apex, thence quite strongly convergent and but feebly sinuate before the hind angles. In *nitens* and *semiopacus* the sides are normally subangulate in front, less convergent and still straighter posteriorly. In *obscurus* there is but one discal puncture except in very rare instances, an extra puncture being present on one side only in two examples of a series of forty specimens. In *nitens* the majority of specimens have two discal punctures, one of which is frequently lost on one or both sides; while in *semiopacus* there are normally three or four punctures, very rarely only two. Although quite variable in size, *obscurus* is on the whole our largest and broadest species (4 1-2 - 6 mm). In color it is rather strongly bronzed, the base of the antennae and tibiae paler. The lateral interstriae are at most slightly alutaceous, often scarcely visibly so except at apex, which is usually obscurely yellowish, the pale shade sometimes extending well forward, becoming gradually evanescent.

Obscurus is known to me only from the Sierras of California, ranging from Shasta (Blaisdell) to San Bernardino, occurring only near the summit of the mountains in the south, but at lower levels toward the north.

10. *N. nitens* Lec.

Closely allied to *obscurus*, but smaller, with relatively smaller head and with the sides of the prothorax straighter and less convergent behind. The elytral striae are as a rule scarcely impressed and more finely punctured, and the lateral intervals are always distinctly alutaceous. In the type there is but a single discal puncture, but the normal number (if there can really be said to be one) seems to be two. In the seven examples at hand, four have two punctures, two have two punctures on one elytron and one on the other, while one has the disk of each unipunctate. In the type there is a yellow spot or vitta in the apical fourth; this is more or less evident in most specimens, but may be entirely absent.

The type and only specimen known to Le Conte was taken by Dr. Cooper at Prairie Paso, Oregon. The species seems not to have since been recognized by collectors, but I am quite confident that specimens taken at Dalles, Oregon and Coeur d' Alene, Idaho, by Mr. Wickham, are the same species. With these I have also placed a Waco, Texas specimen sent by Mr. Knaus, and a perfectly similar one, also from Texas, but without exact locality, belonging to the Cambridge Museum collection These are a little smaller than the northern examples, but scarcely differ otherwise; in each the elytra have two discal punctures.

11. *N. semiopacus* Esch.

The finely very numerously striate front and opaque sutural and lateral intervals of the elytra make the recognition of this species at once easy and certain. The head is barely as wide as the prothorax, the latter less narrowed behind than usual, the sides subangulate in front and nearly straight posteriorly; elytral striae fine, dorsal punctures usually three, rarely two or four, frequently with a dull luteous lateral vitta, which may be entire, or distinct only toward the apex.

Occurs in Oregon and California, all specimens but one known to me being from the latter state. The following Californian localities are represented: San Diego, Poway and Lampson's Flat (Middle Sierras, 1800 ft.)—(Blaisdell); Pomona, Pasadena, San Bernardino (Fenyes) and Catalina Island (Fenyes).

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LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—LXVI.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Cosymbia lumenaria Hubn.

The larva has been observed by Dr. S. H. Scudder, who published descriptions of the last stage and pupa (Psyche, viii, 103, 1897). His description was previously quoted by Packard (Mon. Geom., 363, 1876), who gives also a figure of the larva after Abbott (Mon. Geom., pl. 13, fig. 22, 1876) and of the pupa (loc. cit., pl. 13, fig. 14). The food plant observed by Scudder was sweet fern (*Comptonia*); Abbot gives *Psoralea,* while my larvae fed on blueberry (*Vaccinium*). I have described the egg and first stage in British Columbia larvae (Proc. U. S. Nat. Mus., XXVII., 901, 1904).

Egg Long elliptical, ends rounded, depression slight, the sides compressed, not strongly flattened. Reticulations coarse, even, well raised and rounded, irregularly hexagonal. Size .6 x .3 x .25 mm.

Stage I. Head round, whitish. Body moderate, slender, dorsum and venter broadly dark grey, sides narrowly whitish. Feet pale.

Stage II. Head quadrately rounded, thick, equal, dull luteous with a faint smoky band, later all smoky shaded leaving an erect pale line on each lobe; width .3 mm. Body moderate, normal, dorsum and venter broadly smoky olivaceous black, sides narrowly pale greenish. Thoracic feet pale, abdominal ones blackish, shields and tubercles invisible, concolorous.

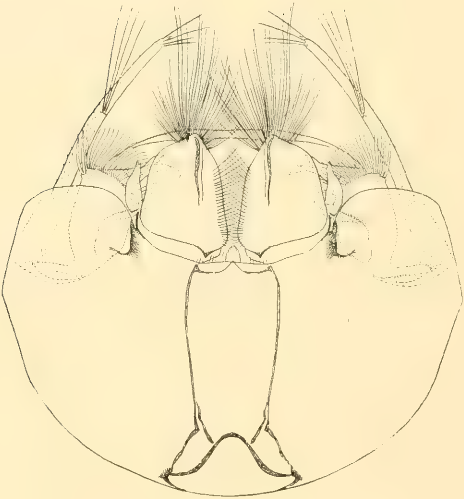
Stage III. Head full, erect, thick, bilobed, finely gray-brown dotted, leaving a pale vertical streak on each lobe; clypeus and a spot each side white; width .4 mm. Body moderate, seeming flattened, broadly velvety brown dorsally and ventrally, sides narrowly bright greenish white, from joint 2 to the anal feet; foot of joint 10 brown. Tubercles, setae and shields concolorous, invisible. Traces of indefinite white subdorsal lines in the brown dorsal area.

Stage IV. Head full, thick and rounded, slightly bilobed, red brown with white dotting; a vertical stripe of white on each lobe with a dot below beside the clypeus, labrum white; width .75 mm. Body moderate, uniform, annulate somewhat irregularly, red brown, sides white, a fine, broken, narrow subdorsal white line, retracted intersegmentally and more distinct than a still finer straight dorsal line. Outline of white lateral area irregular, a little shaded. Feet brown, the anal pair white outwardly. Tubercles small, dark, showing in the white area; setae fine, small.

Stage V. Head moderately bilobed, erect, broad; ground white checkered with red brown in alternating oblique bars, leaving a white streak over the vertex of each lobe and eye, in clypeus and over labrum; a black shade before ocelli; width 1.1 mm. Body broadly dark brown dorsally, shading to olivaceous at the sides, including a narrow pulverulent dorsal and subdorsal line, the latter waved; subventral fold broadly pale yellow. Venter and feet, except those of joint 13, dark blackish vinous. Tubercles small, dark, no shields, setae minute. Segments rather finely annulate but not distinctly.

Stage VI. Head large, round, thick, distinctly bilobed, light red-brown from the dotting, the ground white, appearing in a vertical streak on each lobe and irregularly over the sides; median suture at vertex and clypeus more blackish, labrum whitish; width 1.6 mm. Body moderate, uniform, smooth. Dorsum brown with velvety black oblique streaks from the segments anteriorly, joining dorsally and extending laterally to the pale yellow subventral area, distinct on joints 5 to 8, smaller on joint 9, scarcely indicated on the other segments. Dorsal line straight, subdorsal waved, pale yellow, broken, dotted; also a broken lateral line, partly confluent with the subventral area. Venter nearly solidly black, dotted with white, forming faintly a double medioventral line. Thoracic feet gray, abdominal ones red-brown, anal ones white-banded without. Another larva was pale but with the same marks. The brown of the dorsal area shades to lilaceous and pales gradually to the subventral area.

Pupa described by Scudder and figured by Packard.



Deinocerites cancer—ventral view of larval head. (Fig. 1.)

NOTES ON DEINOCERITES CANCER THEOBALD.

BY FREDERICK KNAB, WASHINGTON, D. C.

The writer has had occasion to study this mosquito in the course of his work in connection with Dr. L. O. Howard's forthcoming monograph of the Culicidae. As a number of incorrect statements have been published about *Deinocerites* the following observations seem timely.

Deinocerites cancer was found by the writer on both coasts of Costa Rica, at Puntarenas on the Pacific side and at Port Limon on the east coast. The species was first encountered far up the mangrove inlets behind Puntarenas. It was established in the holes of a very large and brightly colored species of crab (*Cardisoma crassum* Smith). These crab-holes were near the head of tide water, above overflow, often a considerable distance from the water, and the water in them must have been very nearly if not quite fresh. In some of these holes on very low ground the water was quite near the surface, and the larvae in great numbers and of various sizes, could be seen suspended by the surface film. About Puntarenas *Deinocerites* appeared to be the only species of mosquito inhabiting the crab-holes. At Port Limon the writer found two other species associated with *Deinocerites* in crab-holes, in fact it was there greatly outnumbered by them. One of these species has been recently described by Mr. D. W. Coquillett under the name *Tinolestes latisquamma* and the other he referred to *Culex scholasticus* Theobald.* Dr. M. Grabham has found *Culex janitor* Theob. associated with *Deinocerites* in crab-holes in Jamaica (Theobald, Monogr. Culic., v. 3, p. 185). At Port Limon the crab-holes were on a side hill, in a cacao orchard at some height above sea-level. The water in them was entirely fresh, supplied by a small brook which had worn a channel into the stiff clay of the hillside. Most of these holes went to a great depth to reach the water, so that the mosquitoes living in them never see the light until they attain the winged state. This record of the occurrence of the larvae of *Deinocerites* in fresh water is not made in contradiction of the previous records of its occurence in brackish water. The larva was found in brackish water by Dr. H. G. Dyar in southern Florida and by Mr. A. Busck in the west Indies and it would seem that it thrives best in brackish water and there the species of *Culex* are not associated with it.

The imagos likewise inhabit the crab-holes and during the day rest upon the sides of the hole. It takes considerable disturbance to drive them out and they then fly slowly out of the hole and sometimes to some other nearby hole. Usually however, they alight in the immediate vicinity of their hole, upon the ground or very near it, and after a very short interval fly back into the hole. At twilight the adults may be seen dancing in a small cloud close to the mouth of the crab-hole. Mr. Busck, who has had many opportunities to observe *Deinocerites* in the West Indies, has found that the species swarms in the morning twilight as well as in the evening. As with other mosquitoes, the swarming indicates the time of sexual activity and Mr. Busck has frequently noted copulation at such times.

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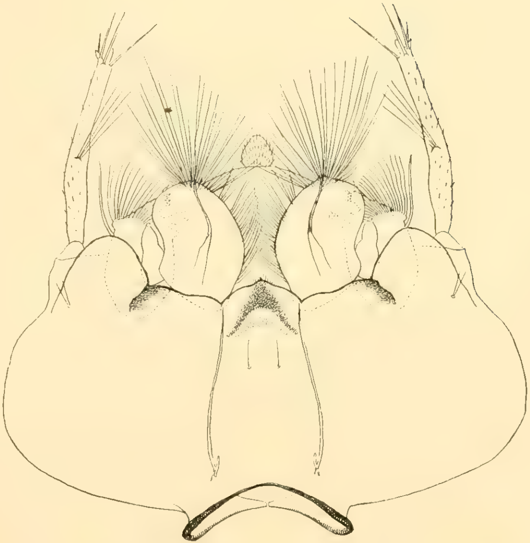
*It is, however, apparently not the form so identified by Dr. Dyar and the writer (Journ. N. Y. Ent. Soc., xiv. 182, 1906).

Dr. Grabham states of *Deinocerites* "only comes out to feed at night, is a voracious bloodsucker" (Theobald, Monogr., v. 2, p. 356). In contradiction Theobald in v. 3, p. 279 of his Monograph quotes Dr. Low who "could never get them to bite. In many dissected from Calliagua, a village in St. Vincent, I never saw any traces of blood in their stomachs." In the writer's experience, *Deinocerites* could never be induced to bite nor would it even alight upon the person. Mr. Busck is also quite positive that it does not molest man. In Trinidad numerous crab-holes, each with its swarm of *Deinocerites*, are found in the immediate vicinity of the houses—often within a few feet. Still these mosquitoes never enter the house nor is anyone ever bitten by them. Perhaps the larvae even serve a useful purpose in preventing the water in the crab-holes from becoming offensive.

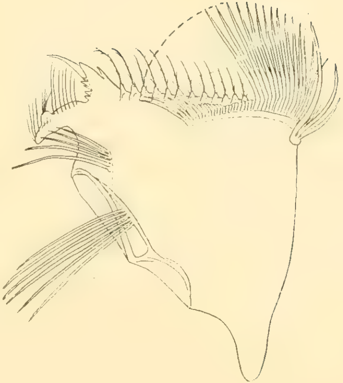
While this mosquito is remarkable in many ways there are no structural characters which, in the writer's opinion, justify the creation of a distinct subfamily for it as has been done by Miss E. G. Mitchell in Psyche, v. 13, p. 19. The unusual length of the second antennal joint, brought forward as a discovery of Mr. Coquillett, has already been commented on at some length by Theobald (Monogr. v. 2, p. 215-217; v. 3, p. 275-277).

The larval peculiarities of *Deinocerites* pointed out by Miss Mitchell are merely an amplification of structures present in other Culicid larvae. The groove in which the mandibles move is by no means peculiar to *Deinocerites* but common to all mosquito larvae and present in the larvae of many other Nemocera. To show the correspondence of parts and their modification ventral views of the heads of *Deinocerites cancer* and *Janthinosoma jamaicensis* are here figured. The integument of the ventral surface of the head is transversely folded in the region of the mouth and forms a ridge extending entirely across the head. In the depression behind this ridge lies the mouth with its ap-

PLATE VI.



Janthinosoma jamaicensis—head of larva, ventral view. (Fig. 2.)



Culex vector D. & K.—mandible of larva. (Fig. 3.)

pendages. It is this transverse ridge with its supporting chitin laterally expanded that forms the projecting angles so characteristic of *Deinocerites*. The same lateral expansion of this region occurs again in the larva of the Sabethid *Lesticocampa lunata* Theobald. The modification of the ridge into rounded lobes, outward from the maxillae, as illustrated in the accompanying figure of *Janthinosoma jamaicensis*, occurs in most mosquito larvae but may be absent, as in *Psorophora*. The mandibles are truly most strikingly modified in *Deinocerites* but they are by no means unique, as Miss Mitchell asserts. There are no less than five species of *Culex* known to the writer which present similar modifications in the form of the mandibles. A mandible of one of these species, *Culex vector* Dyar Knab, drawn by Miss Mary Carmody, is here reproduced (fig. 3). It will be noted that the basal portion of the mandible, instead of being rounded off as is the case in most mosquito larvae, is drawn out into a slender straight projection which corresponds to the curved projection in *Deinocerites*. The toothing of the cutting surface of the mandibles shows various modifications, particularly in the tropical species examined by the writer, but it is doubtful that they will have any classificatory value.

Miss Mitchell has fallen into error in her description of the labial plate of *Deinocerites*. There are three of these structures, overlapping each other, present in Culicid larvae. Usually the outer one of these plates is the stoutest and heavily pigmented so that it obscures the other two which are more delicate and transparent. It is this outer heavily chitinized plate which has been made use of in descriptive work, while the other two have remained unnoticed or at least disregarded. It is one of these inner plates that Miss Mitchell describes in her article. The outer plate is perhaps difficult to find in dissecting, but it is obvious enough when the entire head is examined ventrally. It is usually small, and pale like the head integument, but its general form corresponds with that of other mosquito larvae. It may be remarked in conclusion that Raschke (Die Larve von Culex nemorosus 1887) does not consider this plate a labial structure but as belonging to the integument of the gular region. M. T. Thompson has recently expressed the same belief and terms the part "mental sclerite," (Proc. Boston Soc. Nat. Hist., v. 32, p. 170).

THREE NEW SPECIES OF NEUROPTERA.

BY NATHAN BANKS, EAST FALLS CHURCH, VA.

New species of the true Neuroptera are not abundant in our country, and the three following species represent recent additions to my collection. The *Allochrysa* is one of the largest and most elegant of our Chrysopidae; while the *Panorpa* is interesting, since it shows the value of the male genitalia. By the wing-markings this species resembles two of our most common forms, but the genitalia show that it is related to a different section of the genus. With these three new species I have added new names for three old species, two of which had preoccupied names, and the other based on a mis-identification.

Allochrysa arizonica n. sp.

Head pale greenish yellow, cheeks rufous, last joint of palpi marked with a red band; an angulate red band just above antennal sockets from eye to eye. Thorax greenish yellow, a red spot on each anterior corner of the prothorax, and an angulate red band on the front part of mesothorax from wing to wing; abdomen brownish, discolored, bases of ventral segments paler; legs pale yellowish, the claws reddish. Wings hyaline, venation pale greenish, the bases of the cross-veins between the radius and sector blackish, the gradate series dark, and some of the cross-veins in basal part of wing more or less dark; hind wings pale, venation pale; the pterostigma brown, much more prominent than in the fore wings.

Expanse 52 mm.

One specimen from Palmerlee, Arizona (Biederman). Differs from *A. virginica* in red bands on head and thorax, and in absence of dark spot at end of cubitus in fore wings.

Chrysopa majuscula n. n.

I propose this new name for my *Chrysopa erythrocephala*, which name is preoccupied by Leach for an European species.

Chrysopa injusta n. n.

I propose this name to replace my *Chrysopa marginalis;* Father

Longinos Navas has published a *C. marginalis* a few months before me in the Bol. Soc. Aragon. Cienc. Nat., IV., May 1905.

Psammoleon guttipes n. sp.

Myrmeleon ingeniosus Hagen, Syn. Neur. N. America, p. 236, 1861, not of Walker.

Walker's type of *Myrmeleon ingeniosus* is from Brazil. It has a much narrower pronotum, the thorax is more spotted, the abdomen more banded with pale, and the legs not sprinkled with black dots; I therefore propose a new name for our species. Hagen had already noticed these differences in 1860, but had few specimens; since then it has been found that these forms are more constant in markings than formerly supposed.

Suhpalasca floridana n. sp.

Head brown, clypeus and mouth-parts yellowish; vertex with dark brown hair, face with two rosettes of long, dark brown hair each side; antennae pale, narrowly annulate with brown, club dark brown; thorax brownish; legs pale, tips of the tibiae and of all tarsal joints black, spines black. Abdomen brown, segments 4, 5 and 6, with a narrow, curved black stripe on each side above, margined with yellow; tip each side with a yellow spot containing a black dot on posterior edge; male appendages pale, scarcely one-half the length of the last dorsal segment, depressed. Wings hyaline, venation pale brownish, pterostigma pale brown. Structure similar to *S. hyalina*.

Expanse 50 mm.

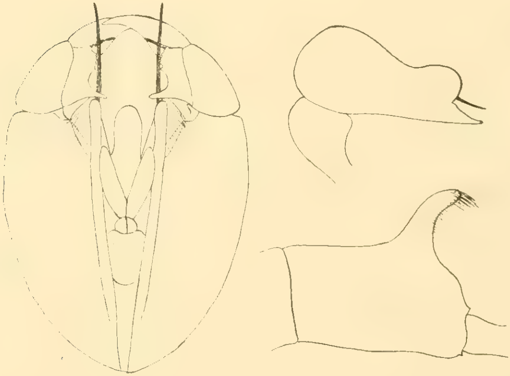
One male from Southern Florida. Differs from *S. hyalina* at once by the dark hair on face, as dark as that on vertex. Dr. H. W. van der Weele, who is making a special study of this family, writes me that our species of *Ulula* (*Ululodes* Currie) belong to the genus *Suhpalasca*.

Panorpa virginica n. sp.

Pale yellowish; antennae black, except the basal joints; abdomen brown, apex yellowish. Wings hyaline, faintly yellowish on basal part; a rather broad apical band; a narrow, geniculate pterostigmatical band; an interrupted basal band of two equal spots; three basal spots, the central one the largest, a costal spot beyond basal band; and a posterior marginal spot between pterostigmatical and apical bands. In hind wings only the three bands distinct. Subcosta runs into the pterostigma; wings not very long. Sixth abdominal segment of the male rather short, with a large, high, curved horn above, somewhat before the tip. Genitalia as figured; the apical joint with a large lobe above, toothed on inner margin, harpes very slender.

Length fore-wing 12 mm.

Two males from Falls Church, Va., 11 August, and 10 October. By structure of genitalia it is related to *P signifer* and *P subfurcata;* but the horn on sixth segment is much larger and the lobe of genitalia of different shape; it is quite different in markings, and in this respect much like *P. rufescens.*



Panorpa virginica; end view of male genitalia; side view of same, and side view of fifth abdominal segment.

PSYCHE, VOL. XIII. PLATE VII.

ROLAND HAYWARD.

ROLAND HAYWARD.

BY SAMUEL HENSHAW, CAMBRIDGE, MASS.

Roland Hayward, who died at Milton, Massachusetts, April 11, 1906, was born in the house in which he died, March 7, 1865. The son of Isaac Davenport and Mary Bartlett (Vose) Hayward, he was educated at the best private schools in Boston, and entered the Lawrence Scientific School, Harvard University, in 1882; though he continued his studies in Cambridge until his senior year, he did not attempt, on account of ill health, the examinations necessary for graduation. After a brief service in a banking office, he became, on December 30, 1887, a member of the Boston Stock Exchange; at first by himself, and later associated with Mr. W. S. Townsend, for fifteen years until his retirement, July 1, 1902, his business relations were noted, as was his life, for the strictest integrity and loyalty.

Though Hayward's love of nature can not be traced to any ancestor, the place of his birth may well have been influential; for here, where the greater part of his life was passed, under the shadow of one of the most beautiful of the lesser hills of New England, he found keen enjoyment in rambling through the pastures and meadows, for many generations the possession of his forefathers. Here the nucleus of his collections of birds' eggs, butterflies, and beetles was gathered; and here a pursuit, not unusual for a boy, matured into the work of a scientific man, work that was conscientious and thorough, and unusual for one actively engaged in business, and thwarted by a severe physical illness.

Though his active business career limited the number and extent of his holidays Hayward made collecting trips to Colorado, Manitoba, New Brunswick, and to many sections of New England, and by his own efforts accumulated a serviceable series of the Coleoptera of North America. This series was increased by gift, exchange, and judicious purchase and by will devised to the Museum of Comparative Zoölogy.

Roland Hayward, when a lad of less than fourteen, was admitted as a member of the Boston Society of Natural History, a Society whose exhibited collections of New England insects did much to focus and cement his life interest in entomology, and to this institution he bequeathed from his library such works on entomology as were not already its property. He was a founder of the Boston Zoölogical Society, a short-lived Club of boys and young men, to whose creditable Quarterly Journal Hayward contributed several short notes. Elected to active membership in the Cambridge Entomological Club, December, 1879, he was at all times alert to the interests of the Club, serving first on the Council, and later as Secretary from January, 1886, to January, 1903, and as Treasurer from January, 1901, until his death.

Hayward's two important systematic papers deal with difficult genera, Bembidium and Tachys, of the Carabidae; a third paper, "Studies in Amara," practically completed before his death, will be issued by the Amreican Entomological Society. These papers, the result of patient and earnest effort, contain the essentials of good taxonomic work: the tables are clear and consistent; the descriptions adequate and careful, detailed but not redundant; the habitats recorded in full; and the bibliographic citations accurate. Hayward was, moreover, eminently fair to the work of his predecessors; he strove long and successfully in order that he might learn the personal equation of each author.

The list which follows includes the more important writings of Roland Hayward, but some short notes and the reports of verbal communications are not recorded.

LIST OF WRITINGS.

1. 1882. *Selenophorus ellipticus* at Nantucket. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, p. 10.
2. 1882. Notes on the habits and distribution of the Massachusetts Rodentia. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, pp. 13-18.
3. 1882. Another spotted egg of *Empidonax minimus*. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, p. 26.
4. 1882. Habits and transformations of *Bolitotherus bifurcus* Fab. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, pp. 35-36.
5. 1882. Two rare Carabidae from eastern Massachusetts. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, pp. 37-38.
6. 1882. *Cicindela ancocisconensis* (Harr) in Vermont. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, p. 38.
7. 1883. A catalogue of the Coleoptera of the Green Mountains. [With Henry Savage.] *Quarterly Journ. Boston Zoöl. Soc.*, vol. 2, pp. 12-15; 24-29; 36-38.
8. 1883. Rare Lepidoptera around Boston during the past summer. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 2, p. 56.

9. 1883. A note on *Acmaeodera culta*. *Quarterly Journ. Boston Zool. Soc.*, vol. 2, p. 56.

10. 1884. On the sexual characters of *Boletotherus bifurcus*. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 3, pp. 16-17.

11. 1885. Curious food for the Kingfisher (*Ceryle alycon*). *Auk*, vol. 2, p. 311.

12. 1897. On the species of Bemlidium of America north of Mexico. *Trans. Amer. Ent. Soc.*, vol. 24, pp. 32-143.

13. 1897. Preliminary hand-book of the Coleoptera of northeastern America. [Bembidium]. *Journ. N. Y. Ent. Soc.*, vol. 5, pp. 133-149.

14. 1900. A study of the species of Tachys of Boreal America. *Trans. Amer. Ent. Soc.*, vol. 26, pp. 191-238, plate 6.

15. 1901. Synonymical notes on Bembidium and descriptions of new species. *Trans. Amer. Ent. Soc.*, vol. 27, pp. 156-158.

16. 1901. The katydid's call in relation to temperature. *Psyche*, vol. 9, p. 179.

17. 1902. A note on the secondary sexual characters of Omophron. *Psyche*, vol. 9, p. 304. *Cf.* p. 335.

18. 1904. An abnormal specimen of *Bembidium scudderi*. *Psyche*, vol. 11, p. 14.

19. 1905. On the secondary sexual characters of Notiophilus. *Psyche*, vol. 12, p. 95.

A NEW CARIPETA.

In going through Packard's Monograph of the Geometridae, I find that he made an error in calling Figure 52, Plate IX, *Caripeta angustiorata* of Walker; and since the insect figured is undescribed I propose the name *Caripeta criminosa* for it. Detailed description with particulars will follow in the September number of the Journal of the New York Entomological Society.

L. W. Swett.

RECENT ENTOMOLOGICAL LITERATURE.

GENERA INSECTORUM; CHIRONOMIDAE. BY DR. J. J. KIEFFER.

The forty-second part of Wytsman's Genera Insectorum, written by Dr. J. J. Kieffer, which has just appeared, deals with the Chironomidae. While there are no startling innovations in classification, the author has erected several new genera by division of some of the older ones. The family is divided into five subfamilies; the Clunioninae, Tanypinae, Chironominae, Ceratopogoninae, and Stenoxeninae. The second, third and fourth subfamilies correspond approximately to Meigen's genera, Tanypus, Chironomus, and Ceratopogon. The position of Diamesa among the Tanypinae may be questioned, for both larval and imaginal characters point to a much closer relationship to Orthocladius and Thalassomyia among the Chironominae. The family Stenoxenidae is here reduced to subfamily rank under the Chironomidae, thus following Aldrich. Wulpiella is made a synonym of Metriocnemus; four subgenera are erected under Orthocladius; Diamesa is broken up into two genera, Prodiamesa and Diamesa, the latter with two subgenera; Psilotanypus is separated from Procladius; Protanypus from Anatopynia, and Trichotanypus from Tanypus. In the subfamily Ceratopogoninae, Heteromyia and Serromyia have been raised to generic rank, while Ceratopogon, Bezzia, and Palpomyia each have two or three subgenera under them.

Considering the extent of the work, very few errors of either omission or commission can be found. The following, of interest to American readers, may be noted. Orthocladius fugax cannot belong to the subgenus Dactylocladius since it is said to have hairy eyes; Diamesa nivoriunda Fitch (p. 36) should be omitted (See Bul. N. Y. State Museum No. 86, p. 274, line 15); Tanypus steinenii Gercke is not North American; Culicoides scutellatus Meigen is classed with both Culicoides and Ceratopogon; Bezzia venustula is listed with both Ceratolophus and Bezzia; Ceratolophus pictus seems to be omitted; and Thalassomyia fusca (No. 3, p. 14) should be omitted; it is the same as Th. obscura and the name is due to a *lapsus memoriae* on the part of its author. The name Ceratolophus is preoccupied and should be changed. The four plates which show figures of wings and other details of structure are excellent, in many cases better than the originals from which they are copied.

The paper is a noteworthy contribution to the study of the Chironomidae and the author, Dr. Kieffer, is to be congratulated upon its excellent arrangement and fine appearance.

O. A. JOHANNSEN.

PROCEEDINGS OF THE CLUB.

The 255th regular meeting of the Cambridge Entomological Club was held in the rooms of the Appalachian Mountain Club on Tuesday evening, March 20, 1906, with fifteen members present. In the absence of the President, Mr. Emerton occupied the chair. Mr. Frost was elected secretary pro tem. Reading of the minutes of the previous meeting postponed.

The subject of "Winter Collecting" was opened by Mr. Emerton and several undetermined species of small insects exhibited. Mr. Sampson said he had tried his light during the warm weather of January and had seen one moth that was attracted by it. The remarks finally drifted into a discussion on the liberation or emergence of Lepidoptera during the winter months. The fresh and unrubbed condition of many captured specimens was used as an argument in favor of the latter theory.

Mr. Kincaid exhibited a box of Coleoptera that he had collected during a six weeks' stay at the Bermudas and remarked on the scarcity of the insects of this order on those islands. He said that many of the specimens exhibited were rare and some new to the fauna of the Bermudas.

Mr. C. A. Frost presented a paper on the alder weevil, *Attelabus rhois* Boh., and its parasite, containing his investigations of their habits, and the method of constructing the nest or egg roll.

The rest of the evening was given over to informal conversation and an examination of the collection of spiders in alcohol and the models of different kinds of webs that had been placed on public exhibition in the rooms by Mr. Emerton.

C. A. Frost, *Sec. pro tem.*

The 256th regular meeting of the Cambridge Entomological Club was held in the rooms of the Applachian Mountain Club on Tuesday evening, April 17, 1906, with thirteen members and one visitor present. President Field in the chair. Records of previous meetings read and approved.

The President announced the death of the Treasurer of the Club, Mr. Roland Hayward, and appointed Messrs. Johnson, Newcomb and Emerton to draw up an expression of regret to be entered on the records. The committee presented the following statement which was accepted by the Club:

"It is with deep regret that we record the death of Roland Hayward, for twenty-seven years a member of the Club and of late its Treasurer, who died at his home in Milton on April 11, 1906. He made a special study of the Coleoptera. He had contributed many papers upon the order and at the time of his death was engaged upon a monograph of the genus Amara. The Club hereby expresses its high esteem for Mr. Hayward as a brother entomologist and its keen sense of loss at his untimely death."

Mr. Bowditch was elected Treasurer to fill the vacancy caused by the death of Mr. Hayward; and Mr. Frost was elected Secretary in place of Mr. Clark, resigned. Mr. Andrew J. Lloyd of Boston and Mr. W. T. M. Forbes of Amherst were unanimously elected to active membership.

Mr. Emerton explained the purpose of the organization of the Federation of Natural History Societies and read a draft of the By-Laws. Mr. Denton was elected to represent the Club at the meeting of the delegates in Boston on April 28, 1906.

Mr. Titus, employed by the Division of Entomology at Washington, D. C., and Secretary of the Washington Entomological Society, spoke briefly on the work of examining and caring for the imported parasites of the Brown-tail and Gypsy moths at Lynnfield, Mass. He said that many European species of spiders were appearing from the Brown-tail nests, and that they would be liberated along with the primary parasites.

Mr. Denton exhibited a specimen of *Rhescynthus semialba* from Central Africa, a large beautiful moth which, so far as he knew, was represented by only one other specimen in the country.

Dr. Russell exhibited photographs of some remarkable examples of the webs of *Archips cerasivorana* that occurred in Winchendon several years ago. He also showed a fine series of the moth with two species of Hymenopterous and two species of Dipterous parasites. For the New England collection, he had two boxes of specimens of the genus Apatela (Acronycta) which were taken at Winchendon, Mass.

Mr. Newcomb, who has been making automobile trips with the Superintendent for Suppressing the Gypsy and Brown-tail moths, spoke very highly of the work that is being done by the employees and the men in charge.

After that, informal conversation and adjournment.

C. A. FROST, *Secretary.*

ERRORS IN THE APRIL-JUNE NUMBER OF PSYCHE.

A number of very unfortunate errors marred the last issue of this journal. The most serious was the omission of the name of Mr. Weeks' new butterfly, Carystus ambrosei. To remedy this defect a corrected rendering of pages 67 and 68 is furnished with this number, and each subscriber is requested to make the substitution at once. Mr. Girault has furnished the necessary corrections for his article, and they are printed below.

THE EDITORS.

THE BEDBUG, CIMEX LECTULARIUS LINNAEUS.

Errata et Corrigenda, *Part II*[a].

Page 42, foot note *a*, 2nd line,	*lectnlarius*	read	*lectularius*.
Idem. 3rd. line,	*Clinoris*	read	*Clinocoris*.
Page 45, third paragraph, last line,	*d'entrés*	read	*d'entrée*.
Page 46, Idem, 2nd line,	omit the letter *l* before *séances*.		
Page 47, second paragraph, last line,	*trasmit*	read	*transmit*.
5th paragraph, lines 2 and 3,	*verstchiedener*	read	*verschiedener*.
idem, 3rd line,	*Centralblats*	read	*Centralblatt*.
Page 52, third paragraph, 3rd line	*Boil.*	read	*Biol.*
Idem, sixth paragraph, last line,	*Laidy*	read	*Leidy*.
Page 54, third paragraph, 1st line	*memoires*	read	*mémoires*.
idem, 6th line,	*gives*	read	*give*.
4th paragraph, 1st line	*Jordens*	read	*Jördens*.
Page 56, 4th paragraph, 1st line,	*Kunckel*	read	*Künckel*.
idem 6th line	*oderiferous*	read	*odoriferous*.

ALEC. ARSÈNE GIRAULT.

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[a] Psyche, XIII. 1906, pp. 42—58.

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EXCHANGES.

[Exchange notices (not over five lines) inserted free for subscribers. Notices will be inserted in the order in which they are received, and those at the top of the column will be removed only when it is necessary to make room for new ones at the bottom.]

WANTED—Eggs, larvae or pupae of grasshoppers, dragon-flies, beetles, bugs, etc. Will give tropical butterflies in exchange. Denton Bros., Wellesley, Mass.

WANTED—Material for the study of the hybrid or polymorphic butterflies of the genus *Basilarchia*, including larvae or pupae of *arthemis* or *astyanax*, imagos of *proserpina* or *arthechippus* or any specimens showing unusual characters. Liberal exchange. Specimens retained will be deposited in Museum of Comparative Zoology. W. L. W. Field, Milton, Mass.

LEPIDOPTERA—For exchange, fertile eggs of *Hemileuca maia*. Alfred C. Sampson, Sharon, Mass.

I have a few specimens of *C. calleta* and *cinctus* to exchange for rare *Sphingidae* or Pupae of same. W. T. Buxton, 17 Walter St., Somerville, Mass.

WANTED—Ova, larvae or pupae of *Limenitis ursula* and *arthemis*. Will give cash or exchange. H. H. Newcomb, 35 Court St., Boston, Mass.

Will collect Diptera, Hymenoptera, Hemiptera and Coleoptera. Would like in exchange, quantities of named or unnamed Buprestidae, Scarabaeidae, Cerambycidae and Chrysomelidae. Please write immediately to G. Chagnon, P. O. Box 186, Montreal, Canada.

Correspondence desired regarding Rhopalocera of North and South America, especially Argynnis, Papilio, Morpho, Caligo. Exchange or otherwise. T. H. Shepherd, 15 Hope View, Carr Lane, Shipley, Yorks., England.

EASTERN MASS. MOTHS WANTED in exchange for same. Also, reliable colored sketches of larvae of same. C. V. Blackburn, 101 Pine St., Woburn, Mass.

Am willing to make contracts to collect for the season, with private collectors, museums, colleges or any public institution for insects of any order or group desired, either in large or small series. Duplicates of all orders for sale from Colorado, New Mexico, and Arizona. Correspondence solicited. Ernest J. Oslar, 4535 Raleigh St. Alcott P. O., Denver, Colorado.

WANTED—Records of captures of Connecticut insects—especially the rarer species—for the preparation of a State list. Orthoptera and Hymenoptera records desired at once. W. E. Britton, State Entomologist, New Haven, Conn.

CICINDELIDAE of the world wanted. Good exchange in all families of Coleoptera offered. H. F. Wickham, Iowa City, Iowa, U. S. A.

HIPPODAMIA—Live individuals and large masses for variation study desired. Insects collected to order in exchange. The following species especially wanted—H. moesta, 12-maculata and sinuata. R. H. Johnson, Station for Experimental Evolution, Cold Spring Harbor, N. Y.

PSYCHE

NOTES ON THE BEES OF SOUTHERN MAINE: ANTHOPHORIDAE, HALICTOIDIDAE, MACROPIDAE AND PANURGIDAE.

BY J. H. LOVELL AND T. D. A. COCKERELL.

The Anthophoridae, which are represented by numerous species in the Middle States, become comparatively rare in northern New England. At Waldoboro in southern Maine there have been taken as the result of much diligent collecting only five species of Melissodes and one of Clisodon. With few exceptions, which will be noted under the respective species, they are visitors in this locality of the Compositae and fly during midsummer and early autumn. With the exception of Melissodes desponsa Sm., which is rather common, they might easily escape the attention of the general entomological collector.

Melissodes.

Melissodes desponsa Sm.

? 1854 *Melissodes desponsa* Sm. ♀, Cat. Hym. Brit. Mus. 2:310.

This is the commonest species of Melissodes in this locality, and has been taken from July 21st to September 1st. It is a frequent visitor of the larger thistles, especially the pasture thistle (*Carduus odoratus*), though occasionally it is taken on the Canada thistle (*Carduus arvensis*). It also visits more rarely a number of other flowers, as *Pontederia cordata, Inula helenium* and the goldenrod.

Length of ♀ 12–14 mm. Length of ♂ 11–12 mm. This species is readily recognized by its robust form, the thorax clothed with ochraceous pubescence, and the black abdomen without fasciae. The male closely resembles the female, but is readily distinguished by the yellow clypeus and longer antennae; the labrum is entirely black. The female has the hair of occiput black, and the nervures black; it is questionable whether it is Smith's *desponsa*. For this species Robertson has proposed the name *M. cnici*.

Melissodes agilis Cress.

1878 *Melissodes agilis* Cress. ♂, Proc. Ac. Nat. Sci. Phil. p. 204.
1878 *Melissodes aurigenia* Cress. ♀ ♂, Proc. Ac. Nat. Sci. Phil. p. 212.

This species is regularly taken each year on the garden sunflower, but has never been collected on the inflorescence of any other plant. It flies from August 10th to September 2nd. This bee, especially the males, is very active upon the wing and easily frightened. One male is very remarkable, being a partial gyandromorph, with a male antenna on the left side and a female one on the right. The name agilis has priority of place, but the more northern aurigenia form (to which the Maine specimens belong) appears to be more widespread.

Melissodes illata n. sp.

♀.—Length a little over 8 mm. Black, resembling *M. perplexa* Cr., but smaller and less robust, also closely related to *M. vernoniae* Robt., but clypeus of male yellow, and size smaller. Clypeus usually, labrum and upper part of face bare; clypeus rather coarsely and mesothorax finely punctured; sides of face below the insertion of the antennae, pleurae and sides of metathorax clothed with grayish pubescence; hair on vertex mixed with black; dorsum of mesothorax and scutellum covered with short black pubescence, which extends to the tegulae. Wings dusky with nervures and tegulae black. Legs fuscous, posterior pair with scopa on tibiae and outer side of basal joint of tarsi pale ochraceous. Abdomen small, oval, narrowly convex and shining; 1st segment bare except for erect white hairs at base; 2nd segment with oblique fasciae on the sides, interrupted in the middle, also a narrow hair band at base; median white fasciae on 3rd and 4th segments entire; the two apical segments clothed with black hair.

♂.—Length 8 mm. Antennae about the length of the body, fulvo-ferruginous beneath; pubescence longer and more dense than in the female; clypeus and large lunate spot at the base of labrum lemon yellow. Pubescence of legs griseous, on inner side of tarsi orange-red, apical tarsi rufous, tibial spurs pale yellow. Apical margins of abdominal segments testaceous, shining; abdominal fasciae median as in the female, but the band on 2nd segment entire, or nearly so. Acute lateral spines on the extreme sides of the two apical segments.

The female is very like *M. perplexa*, but smaller (perplexa has the size and build of *simillima*); the male is easily known from perplexa by the yellow (instead of creamy-white) clypeus, the upper part of which is not black. Herein it resembles

M. manipularis Smith, but that species has the light hair of the thorax differently colored. All specimens of the female were taken on *Solidago* from August 3rd to August 26th. The male specimens were collected from July 23rd to August 13th on *Epilobium angustifolium, Inula helenium,* and *Solidago.*

Melissodes simillima Robt.

1897 *Melissodes simillima* Robt. ♀ ♂, Trans. Ac. Sci. St. Louis, 7:355.

This species is distinguished from *M. illata* by its larger size, broad abdomen, black fascia on segment four, and red apices of mandibles. *M. simillima* is close to *M. perplexa*, but the female differs from cotype of perplexa by the ocherous tint of the pubescence of thorax, the black hair of middle of face and lower part of pleura, and the color of the hair on fourth abdominal segment. Typical *perplexa* is from Georgia. Collected on *Solidago* and *Carduus arvensis* from August 7th to September 3rd.

Melissodes apicata n. sp.

♀.— Length 10 mm. A robust species with white pubescence. This species differs from *illata*, *simillima* and *perplexa* in having the white abdominal fasciae of fine tomentum apical instead of median, that on the second segment failing in the middle. Facial quadrangle broader than long; clypeus bare, closely and confluently punctured; labrum clothed with pale ferruginous hairs; mandibles rufous at tips; antennae dark with flagellum faintly reddish beneath. Mesothorax with strong punctures on a very shiny ground; hair of disc of mesothorax black, separated from tegulae by a narrow strip of white. Wings strongly dusky, tegulae black. Scopa of hind legs white; hair on inner side of basal joint of hind tarsi nigrofuscous; hair on inner side of middle tibiae largely dark. The abdomen is without metallic tints; abdominal segments 2–4 with white apical fasciae, interrupted on 2; the two apical segments with black hair.

The abdomen and hind legs are very suggestive of those of *Tetralonia actuosa* Cress., although the abdomen is not nearly so rugose as in that species, and the color of the apical hair and the sculpturing of the mesothorax is entirely different. One specimen on the flowers of *Pontederia cordata*, July 21, 1904.

CLISODON.

Clisodon terminalis Cress.

1869 *Anthophora terminalis* Cress. ♀ ♂, Trans. Am. Ent. Soc. 2 : 292.
1879 *Clisodon terminalis* Patton, Bull. U. S. Geol. Surv. 5 : 479.

One female on the flowers of *Pontederia cordata*, July 21, 1904. No species of *Tetralonia*, *Xenoglossa*, or *Anthophora*, have yet been recorded from Maine.

Intermediate between the old divisions of Andrenidae and Apidae there are numerous genera of bees, representing different phylogenetic lines, but possessing the common character of two submarginal cells. They are of special interest to the floroecologist from the fact that many species are oligotropic flower-visitors. In the arid regions of New Mexico it has been observed that most species of Perdita, which are in that area numerous, confine their visits to one kind of flower.* As so little is known of the bees of northern New England, it seems desirable to enumerate the Maine species belonging to this group, and to note their times of flight and flower records.

HALICTOIDES.

Halictoides novae-angliae Robt.

1897 *Panurgus novae-angliae* Robt. ♂, Trans. Ac. Sci. St. Louis, 7 : 339.
1904 *Conohalictoides lovelli* Vier. ♀ ♂, Ent. News, 15 : 244.

This species is a common visitor of *Pontederia cordata*, but it has never been collected on any other aquatic or upon any land plant. The writer knows of no other common bee found at Waldoboro, which entirely restricts its visits to one species of flower. Mr. H. L. Viereck in his description in Entomological News states that this bee is also found at Derby, Pa., and at Chestertown, Md. Robertson described it from "Mass., Ct. (A. P. Morse)."

MACROPIS.

1880 *Macropis ciliata* Patton, ♀ ♂, Ent. Mo. Mag. 17 : 31.

The females of this genus are usually regarded as oligotropic visitors of Lysimachia. I have, however, found *M. ciliata* ♀ a common visitor to the umbels of

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* Cockerell, T. D. A. Notes on New Mexican Flowers and their Insect Visitors. Bot. Gaz., 1897, p. 104.

Aralia hispida. Besides this plant the female also visits *Lysimachia terrestris* and *Kalmia angustifolia*. The males visit *Aralia hispida, Sedum acre, Kalmia angustifolia* and the goldenrod. Taken from July 10–27.

PERDITA.

Perdita octomaculata Say.

1824 *Panurgus octomaculatus* Say, ♀ ♂, Long's 2nd Exp. 2 :350.

1888 *Perdita octomaculata* Provancher, Add. faun. Can. Hym. p. 321.

Common on *Solidago juncea* from August 1–27, the females collecting pollen. In one instance this bee was seen on another species of goldenrod.

CALLIOPSIS.

Calliopsis andreniformis Sm.

1853 *Calliopsis andreniformis* Sm. ♀, Cat. Hym. Brit. Mus. 1 :128.

Only two females and three males of this species have been taken at Waldoboro (July 10th to August 7th); and the only flower record is *Solidago juncea*, August 7, 1904. It is rather singular that all five specimens were collected in 1904; while in 1905, when a special effort was made to obtain as many species of Anthophila as possible in this locality, no specimens of *C. andreniformis* were found.

PANURGINUS.

Panurginus asteris Robt.

1895 *Calliopsis asteris* Robt. ♀ ♂, Trans. Am. Ent. Soc. 22 : 121.

One male specimen taken on Solidago, August 17, Waldoboro, Maine. In the table in Trans. Am. Ent. Soc., Dec. 1898, p. 197, this runs to 35, and cannot be separated from *P. asteris* Robt.

NEW DASCYLLIDAE.

BY CHARLES SCHAEFFER, BROOKLYN, N. Y.

Lachnodactyla texana new species

Piceous brown, antennae and legs paler, form of *Ptilodactyla serricollis*, but slightly more robust and the vestiture coarser. Head granulate-punctate; eyes large, separated by slightly less than their own width; antennae long and slender, joints four to ten each with a ramus, which is much longer than the joint to which it is attached. Prothorax twice as wide at base as long, sides compressed anteriorly, arcuately converging behind, hind angles acute and slightly reflexed; base bisinuate, denticulate; surface convex, feebly depressed behind, not very densely granulate-punctate. Scutellum moderate, sub-cordiform, not impressed at base but with four denticles. Elytra elongate, very little wider than the thorax at base, humeri rounded; punctate-striate, striae distinct, intervals finely and sparsely punctate. Apex of fifth ventral segment feebly emarginate. Length 6 mm., width 2.75 mm.

Esperanza Ranch, Brownsville, Texas, May 30, one male.

Differs from the Central American *monticola* by the head being granulate-punctate, scutellum without notch in front and with only two teeth on each side of base, the elytral striae distinct and finely but not rugosely punctate. Some of these characters separate it also from *parviscutum*.

Lachnodactyla arizonica new species.

Ferruginous-brown, closely resembling *Ptilodactyla serricollis*, but slightly more elongate. Head granulate-punctate; eyes rather small, widely separated by more than their own width; antennae slender, ramus of each joint as long, or very slightly longer, than the joint itself, last joint elongate-oval, slightly wider than the penultimate. Thorax at base twice as wide as long, bisinuate, denticulate; sides arcuately narrowing to apex; hind angles acute and feebly reflexed; surface convex and feebly depressed behind. Scutellum moderate, feebly cordate, median impression deep in front, but base without denticles on each side. Elytra elongate, slightly broader than the thorax at base, obsoletely punctate-striate, intervals flat, feebly rugose and finely punctate. Fifth ventral segment at apex feebly emarginate. Length 5 mm., width 2.5 mm.

Huachuca Mts., Arizona, July 25, one male.

This species differs from *texana* by the smaller, more widely separated eyes, rami of antennal joints shorter, scutellum distinctly impressed in front and without denticles on the basal margin; this latter character and the granulate-punctate head separate it also from the two Central-American species.

The genus *Lachnodactyla* is closely related to *Ptilodactyla*, from which it is mainly distinguished by the last joint of maxillary palpi being very elongate and somewhat cultriform, and the third very small. The apical joint in the male is cleft on the inner side and spongy within, the insect apparently having the power of distending it at will as Mr. Champion suggests.

If the figure* of the maxillary palpus is correct, the two species above described differ also from the two Mexican species in the third joint being inserted at the sides near base of the last joint; the palpi having thus somewhat the form of the antennae of certain species of Lachnosterna.

ORA TEXANA Champ. Biol. Cent. Am. Col., vol. III, pt. i, p. 604 (note).

This name is given to the *Scirtes troberti* of Dr. Horn,† which, according to Mr. Champion, is distinct from the Mexican species.

ORA TROBERTI Guér. Rev. et Mag. Zool. 1861, p. 545.

I have a specimen from Brownsville, Texas, which agrees with the description of this species and also nearly with the figure given in the Biologia,‡ except that the elytra are brownish testaceous and not yellow and the third dark elytral stripe is narrowly confluent with the apical dot. I am unwilling to give the single specimen a new name on these variable differences, as it otherwise closely agrees in form, markings, etc., with the Mexican insect.

The genus *Ora* is closely allied to *Scirtes* from which it is separated by the posterior coxae being contiguous in front only, posteriorly separated by the intercoxal process; the thorax and elytra explanate and acutely margined.

Scirtes plagiatus new species.

Ovate, reddish testaceous, head, thorax and an oblique lateral stripe on each elytron piceous. Head shining, finely and sparsely punctate and sparsely pubescent. First joint of antennae stout, second and third small, together as long as the fourth, fourth to tenth feebly decreasing in length, eleventh slightly longer than the tenth and rounded at apex. Thorax very strongly transverse; sides narrowing to apex, apical angles rounded, basal angles feebly so; base arcuate; surface finely and rather sparsely punctate and sparsely pubescent. Scutellum triangular, finely and sparsely punctate. Elytra more strongly punctate than the thorax, sparsely pubescent with fine, recumbent, pale hairs; color reddish testaceous, with an oblique, piceous vitta on each side, extending to about apical fourth, leaving apex and the suture narrowly pale. Body beneath sparsely pubescent; tibiae carinate. Length 3 mm., width 2 mm.

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* Biol. Cent. Am. vol. III, pt. 1, pl. 27, fig. 25a.

† Trans. Am. Ent. Soc., vol. VIII, p. 102, pl. 1, fig. 15.

‡ Biol. Cent. Am. vol. III, pt. 1, p. 603, tab. xxvi, fig. 24.

Huachuca Mts., Arizona, June.

Readily distinguishable from all the described species by the coloration.

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—LXVII.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Euchlaena effectaria Walker.

Egg. Elliptical, rounded, depression and truncation not strong, rounded, the truncation a little oblique. Reticulations large, hexagonal, distinct, tending to lie in longitudinal rows but the cross striae equally heavy; white crests at the angles; surface shagreened; bluish green, turning dull purplish; size .8 × .6 × .5 mm.

Stage I. Head rounded, bilobed, flattish before, erect, not notched, brownish ochraceous, not shining, a little white frosted before; ocelli and jaws black. Body moderate, rather stout, normal, equal, segments slightly widened posteriorly and coarsely annulate. White; a broad, subdorsal vinous-brown band, joined to a single broad dorsal one on joints 10–13; a similar single ventral band, broken about the feet on joints 2–4; feet of joint 10 vinous, of 13 ochraceous, thoracic feet pale. Tubercles small, dark, normal; setae short, dark, very minutely capitate.

Stage II. Head slightly bilobed, flattened before, held flatly, luteous with brown dots in vertical rows, more distinct above; width .5 mm. Body moderate, even, greenish, the dark brown subdorsal and ventral stripes as before.

Stage III. Head broad, flat, held flatly, all dark purplish shaded and dotted, leaving two erect obscure pale sordid lines and a broad lunate band of pale above the mouth; width .8 mm. Body marked as before but filled in with sordid purplish shadings; sides broadly dull greenish, venter and feet dark. Faint narrow pale lines of whitish, addorsal and subdorsal ones the most distinct.

Stage IV. Head gray above with vertical lines of black dots, black on the face surrounding the transverse lunate pale gray bar over the lower part of clypeus; width 1.4 mm. Body moderate, smooth, dark gray dorsally with faint irregular pale addorsal and subdorsal lines; subventer broadly greenish, pale with dark spots on tubercles vii; venter diffusely dark brown. Tubercles black, conical.

Stage V. Head rounded, flattened especially below, held flatly; black, dull on the faces of the lobes, a broad white triangle below over clypeus and above anteriorly reaching up along the median suture; else gray brown, the lobes with vertical rows of oblique black spots in two rows alternating; antennae reddish; width 2 mm. Body cylindrical, normal, thorax depressed, tubercles elevated, tubercle ii of joint 9 especially high forming a pair of black papillae. Anal flap triangular, produced; a pair of subanal cones. Black-brown, reddish brown shaded, no defined lines; a light whitish space dorsally on joints 5 to 7, illy defined, narrowed between the segments, appearing again on joints 10 to 12 less broadly. Venter more ocherous shaded with irregular blackish spots and streaks; lines pale and broken, crinkled, obscure.

Stage VI. Head quadrate, flattened, thicker at the vertex, slightly roundedly bilobed; sordid luteous gray before, a bicusped yellowish white band reaching over the clypeus; above darker gray with obscure straight vertical light streaks, the pale patch and black spots of former stage both absent; a slight darker line on upper angles of lobes; ocelli dark; width 2.8 mm. Body straight, stick-like, roughened by the anal cones and subpapillose dorsal tubercles, of which tubercle ii of joint 9 is much the largest. Back brown, mottled with subdued whitish and gray-black. Irregular light dorsal areas on joints 5 to 7, widest on joint 5 and on joints 10 to 12; joints 8–9 nearly black dorsally and an irregular blackish subdorsal band, rather broad. Sides broadly blackish shaded, leaving the venter narrowly pale. Feet of joint 10 large, pale wood brown, a black ring near the base and many small white dots above; feet of joint 13 dark like the sides. Thoracic feet pale, appressed. All finely mottled and dotted; tubercles black; spiracles black ringed.

Cocoon of coarse silk. Eggs from Washington, D. C., May 29; mature larvae July 21; first moth issued August 7. The larvae were fed on rose leaves. Probably they will eat a variety of food plants. The pupa is dark brown without any noteworthy characters.

NEW ACRIDIIDAE FROM THE SOUTHERN STATES.

BY ALBERT P. MORSE, WELLESLEY, MASS.

SEVERAL previously unnoted members of this family were taken in the summer of 1905 during a second trip in the South under the auspices of the Carnegie Institution of Washington.

Nomotettix cristatus denticulatus var. nov.

This variety, for it is unlikely to be more than that, is more scabrous than the type form, with the margins of the pronotum very minutely serrulate, sides of the vertex of the headless regularly convex, its carina less protuberant, the carina of the pronotum thinner and higher, the middle femora with undulate margins, and the upper edges of the hind femora usually with inwardly or upwardly directed denticulate processes.

Six males, one female; Caddo, Haileyville, So. McAlester, I. T.; Denison, Tex. Aug. 6 to 13.

Hippiscus immaculatus sp. nov.

The specimen under consideration is the size of *H. rugosus*. The pronotum is less rugose, smoother in outline and in surface, a little narrower; the hind margin slightly obtuse-angulate, its sides straight and its apex rounded. Wings like those of *rugosus*, the tip infuscated but not maculate. Ground-color of tegmina a pale, almost vinaceous, brown; the basal half of the anal field suffused with fuscous except along the anal vein; the distal half of the costal field more or less suffused and the basal third finely maculate, the proximal part of the discoidal field evenly suffused, the veins and venules of the distal part more or less infuscated apically, and a slight fuscous suffusion near the base.

Compared with *rugosus* the specimen differs relatively little structurally or in wing-marking, but radically in the tegminal pattern which suggests that of *tuberculatus* but is much less distinct.

One male, Clarendon, Tex., Aug. 18.

Podisma scudderi sp. nov.

Head large, eyes large and prominent, vertex very blunt, but little protuberant,—in form and proportions recalling Dendrotettix. Pronotum robust, depressed rather than compressed, especially at the shoulders, carina distinct on metazone, evanescent on prozone, posterior margin slightly convex, sub-emarginate, sutures deeply impressed. Prosternal spine short, acutely pointed, conical with excavate sides. Tegmina ovate-lanceolate, separated by their own width, anterior margin strongly convex, posterior slightly so, apex evenly rounded. Carina of abdomen indistinct. Valves of ovipositor stout, outer margins finely dentate and strongly sinuate, contrasting markedly in robustness with the same organs in *P. glacialis variegata*, from which the presence of tegmina distinguishes it at a glance.

Color luteous beneath; above mixed olive green, fuscous, and brown, with more or less cherry red on inner and outer faces of hind femora. Feet greenish, tibiae varied, strongly pubescent, with black spines. Length: 25; hind femora: 12; pronotum: 5; tegmina: 4 × 2.5 mm.

One female, Cheaha Mt., Ala., July 13, 2300 feet.

This is a stout-bodied species, resembling Dendrotettix in the form of the head and proportions of the eyes, and the discovery of the male will be awaited with interest. The single example secured was taken while sweeping grass and shrubbery in the vicinity of Pulpit Rock, near the extreme summit of the mountain. Protracted search for a male or additional examples was unavailing.

I take great pleasure in naming this notable species in honor of Mr. Scudder, whose scholarly researches in orthopterology form the foundation on which all later study of the North American representatives of the order must be based; whose interest, example, and friendship have been a never-failing inspiration.

Melanoplus latens sp. nov.

Subgenital plate of male from above rounded apically, in side view short, its lateral and ventral outlines nearly equal, a little elevated apically. Furcula obsolete or represented by two small, rounded protuberances. Last dorsal segment a little emarginate. Cerci long, a little surpassing the supra-anal plate, two-and-a-half times or more as long as their basal breadth, nearly four times as long as their middle breadth, tapering rapidly on basal fourth, bent slightly upward at this point, subequal or slightly expanded sub-apically, tapering to a rounded, flattened apex. Valves of ovipositor of female short, rather blunt and usually dull pointed.

A short-winged, red-legged species having much the habitus of *M. scudderi* and occurring with it in thickets and woodlands. Tegmina acutely pointed, equalling head and pronotum. Vertex of head rather protuberant. Mid-carina of pronotum distinct, equally developed throughout. Prozona slightly inflated. Hind tibiae cherry-red.

Length: ♂, 19–22; ♀, 27–30. Hind fem.: ♂, 12–13; ♀, 14.5–16. Tegmina: ♂, 6.5–7; ♀, 7–8.5 mm.

Caddo, I. T., Aug. 9. Six males, seven females. To this species I refer also three females from Howe, I. T., Bonita, Tex., and Magazine Mt., Ark.

Melanoplus tepidus sp. nov.

This species most closely approximates *M. obovatipennis*, agreeing with it in size and general coloration, but may be distinguished from it by the following characters: — Sub-genital plate of the male feebly but distinctly tuberculate sub-apically; the upper valves of the ovipositor of the female narrower at base in side view; the pronotum is more elongate and slightly inflated, its sides and top slightly convex instead of straight, its lateral lobes less deep, and the longitudinal fuscous stripe thereon broader anteriorly, of nearly equal width throughout, covering one-half or more of their depth; the tegmina are slightly more elongate, the eyes of the male are large and very prominent, and the vertex of the head narrower, more prominent, and rather deeply sulcate.

Three males, three females; Meridian, Miss., July 16.

Melanoplus tribuloides sp. nov.

Similar to *M. tribulus* but with the digits of the furcula much wider and longer, flattened, from enlarged bases, in length equalling or exceeding the middle breadth of the cerci; the cerci narrower in the middle.

Two males, three females; Cheaha Mt., Ala. 2000–2400 feet.

One male, two females; Turnipseed's Ranch, 1000 feet, near base of Cheaha Mt.

Melanoplus tuberculatus sp. nov.

A rather small, inconspicuous species, long-winged, flavescent brown in color, with unspotted tegmina, faintly barred hind femora, and very pale yellowish green hind tibiae. Fuscous stripe of the lateral lobes of the pronotum restricted to the prozona, brownish, sometimes obsolete. Sub-genital plate of the male seen from above smoothly rounded posteriorly, its ventral outline from the side smoothly convex, terminating posteriorly in an upwardly directed, acute, sub-apical tubercle, the lateral margins ampliate at base. Last dorsal segment of abdomen of male emarginate at origin of furcula, the latter consisting of a pair of short, triangular, flattened processes from expanded bases on the segment, scarcely as long as the segment, parallel, and widely separated. Cerci short, but little longer than their basal width, wide and very stout at base, tapering rapidly, the apical half sub-equal, tapering to a rounded apex, bent strongly upward and inward, the apex flattened and a little reflexed. Tegmina a little surpassing (♂) or about reaching (♀) the hind knees.

Body: ♂, 18–22; ♀, 19–27. Tegmina: ♂, 14–18; ♀, 16–19. Hind fem.: ♂, 11–12; ♀, 13–15 mm.

Eleven males, three females; Quanah, Texas, Aug. 21.

One male; Wichita Falls, Texas, Aug. 15.

Melanoplus scudderi latus var. nov.

Two males from Bonita, Texas, which I refer to this species with some doubt, possess exceptionally broad cerci, the depth nearly or quite equalling the length, the lower margin very strongly convex. To this form I apply provisionally the varietal name *latus*.

THE SWARMING OF CULEX PIPIENS.

BY FREDERICK KNAB, WASHINGTON, D. C.

It has been the writer's good fortune to observe the swarming and mating of *Culex pipiens* upon four consecutive evenings, October 15–18, 1904. Many notices of the swarming of Culicidae and related forms have appeared, but most of the accounts deal with the swarming simply as a remarkable phenomenon while its significance escaped them. It therefore seems worth while to record my own observations. Following these I shall give the more interesting data of previous writers, and at the end, a bibliography of the subject.

My observations were made at Urbana, Illinois, under exceptionally favorable conditions. Although the country about Urbana is well drained and there is but little water, mosquitoes were remarkably abundant. As far as could be determined all came from one source. On the outskirts of the town is a small stream, known as the Salt Fork, which, during dry weather, becomes practically stagnant. About a mile up the stream the water was polluted by the discharge from an abattoir. The foulness of the water was such that the fish normally present in the stream were all destroyed and thus an ideal breeding-place for mosquitoes was created. Early in October the writer found the larvae of *Culex pipiens* present in immense numbers, and when the shrubbery bordering the stream was disturbed the imagos rose in great clouds. These mosquitoes, however, showed no inclination to leave the waterside and would quickly return to the shelter of the marginal vegetation.

October 15 was a warm autumn day and its close was marked by one of those clear calm evenings when not a leaf stirs and the air appears to be perfectly still. At five o'clock the writer was crossing a corn-field not far from the stream. The sun was already near the horizon and its direct rays were cut off by an intervening line of tall trees. When near the middle of the field a cloud of mosquitoes was noticed directly overhead. The lowest mosquitoes were about the writer's head and shoulders, the topmost ones perhaps five feet higher; the transverse diameter of the swarm was about two feet. The high-keyed piping, vibrating between two notes in constant rapid reiteration, was very distinct. The variations in tone seemed to correspond to the upward and downward movements of the individuals. In the light of the succeeding observations it would seem that this swarm had been forming above the writer's head from the time he entered the field. The swarm was watched for about twenty minutes. The individuals in the swarm flew up and down amongst each other with a kind of weaving motion — a downward and forward plunge and back again, performed without unison or regularity. The movements were sufficiently slow to allow the plumed antennae of the males to be clearly distinguished and it appeared that the swarm was composed wholly of males. Once a female was seen to dash into the midst of the swarm and emerge on the other side united with a male. The insect-net was swept through the swarm a number of times. At each stroke the mosquitoes would disperse somewhat but returned at once to their former position and continued their dance, and there was no perceptible diminution of their numbers. An examination of the captures showed 897 males and four females. This count includes the female observed passing through the swarm, as narrated above, and it is obvious that the other three females in the capture are not to be considered as members of the swarm. They may have entered the swarm unnoticed in the manner described, or they may even have been hovering about outside of it. The observations of T. H. Taylor (in Miall & Hammond, The Harlequin Fly) show a like condition in Chironomus. On a still evening his captures from a swarm were 700 males, no females. On a windy evening, when the swarm was thrown more or less into disorder by the breeze, a capture of 4300 specimens included 22 females.

Upon turning to leave the mosquito-swarm another one was discovered close by, hovering over and about a corn-stook. The swarm extended about half way down the side of the stook and kept on the south side of it, the mosquitoes all facing northward. Although there was no perceptible breeze it was thought that the attitude of the mosquitoes was in response to a current of air and subsequent observations confirmed this supposition. It was but seldom that one of the mosquitoes alighted on the corn, and as in the cloud first observed, all appeared to be males. A round of the field showed that each corn-stook had its swarm of mosquitoes, and furthermore, single stalks that remained standing had small swarms dancing over them — sometimes of only six or eight individuals — and the bushes and small trees on the edge of the field had their swarms. In every case the mosquitoes faced northward and the swarm kept on the south side of the object of attraction. Always the mosquitoes gathered over some prominent object such as a tree or a projecting branch, a bush, a corn-stook or a person. In this last case the swarm would move with the person and the only way to get rid of it was by passing under some taller object where the swarm would then remain.

On the following evening at five o'clock the field was again visited. Upon approaching the region of the creek swarms of mosquitoes were noted over every tall object — at the tops of telephone-poles, orchard-trees and shrubbery. On a very tall elm, standing alone in a pasture, a swarm was dancing before a projecting branch

In the corn-field the swarms were found, as on the evening before, over every prominent object and as the writer entered the field a swarm immediately began to form over his head. This time, however, the position of the swarms in relation to the objects was the opposite of the evening before — the mosquitoes were now all facing southward and they kept on the north side of the objects. The trees on the south side of the field, some of them 25 or 30 feet high, had immense clouds on their north sides. As on the evening before, there was no perceptible breeze but the drift of smoke showed that there was a current of air from the south. Station was taken near the row of trees bordering the field and some swarms dancing before projecting limbs kept under observation. Repeatedly females were seen to issue from the foliage, dash into the swarm, and emerge united with a male. When in copula the male and female face in opposite directions, their bodies in a horizontal plane; the female dragging the male after her.* The pair (or rather the female) would fly upward for a while and then slowly drift towards the ground. Once a pair in copula was seen to issue from one swarm and plunge into another swarm close by. The pair made great haste to extricate itself while the swarm was immediately thrown into frantic excitement and the mosquitoes danced up and down at a furious pace for some time, until at last the ordinary measure of speed was regained. With the growing darkness the excitement in the swarms increased and the movements became more rapid. Few successful unions now took place. Females entering the swarm would be pounced upon by two or three males, and together, tumbling over each other, they would fall to the ground and there separate. Towards the last no more females appeared and with the increasing darkness the swarms rapidly diminished, the males flying off into the air.

At five o'clock on the following evening the swarms were found as before, dancing over every object projecting above the general level. Single mosquitoes were seen flying rapidly and straight. These looked larger than the dancing males and when captured proved to be females. The air was again very still with a current from the south and, as before, the dancing males faced towards it and kept on the opposite side of the objects. The west side of the field was bounded by tall trees and high up on these, at least fifty feet from the ground, before projecting branches, clouds of mosquitoes could be distinguished while lower down on these trees there were none. Station was taken at a corn-stook to determine how long the dance would continue. As the darkness grew the numbers began to diminish, and at 5.50, when the darkness

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*Goeldi (Os mosquitos no Pará, 1905, p. 74, pl. I, fig. 3*a*) describes and figures the copulation of *Stegomyia calopus*. In that species the male clings to the under side of the female.

was almost complete, the last male flew away. The departing males flew upward and none of them alighted on the stook.

On the fourth evening the field was visited nearly an hour earlier than before. The sun was still shining and there were no mosquitoes present. Later, when the sun had disappeared behind the trees, the swarms were again present just as on the previous evenings. On this evening, however, there was quite a breeze blowing and the mosquitoes could not maintain their position over the projecting objects and swarmed altogether on the leeward side of them. Otherwise their behavior was much the same, only that the freshening wind occasionally threw the swarms into confusion and greater activity. Rain and cold weather followed the next day and put an end to further observations and presumably to the swarming.

There are many records of swarms of Culicidae and related forms, although in many cases there is no exact indication of the identity of the insects in question. I am convinced that all such records, in so far as they refer to swarms of the nature described above, apply to Nemocera and probably in every case either to Culicidae or Chironomidae. I believe that these swarms of dancing males, congregated for sexual intercourse, are peculiar to the Nemocera. Many of the records from untrained observers, called forth by the appearance of these Diptera in extraordinary numbers, though incomplete, are nevertheless of interest. In nearly all of them the fact that the swarming leads to sexual union has been entirely overlooked.

Moufet, in 1634, already speaks of these swarms and notes how they gather at the gables of houses and over the heads of people passing over bridges. It should be noted that in his chapter "De Culicidum" the Culicidae and Chironomidae are not distinguished, as indeed has been the case with many a writer since.

The oldest record of the copulation of Culex appears to be that of the Spaniard Diego Reviglias, communicated to the Leopold-Carolinian Academy in a letter dated 4 March, 1728, but not published until 1737. Reviglias observed under the microscope, and described at considerable length, the sexual union and the copulatory apparatus of the mosquito. He treats his discovery as a very important one, which indeed it was in those days of lingering belief in spontaneous generation. However he does not mention swarming and there is reason to believe that he had before him a species which does not swarm — a matter which I shall take up again farther on. Later the French commander Godeheu de Riville also claimed as the first his observation of the copulation of mosquitoes, made on board his ship. The account is quite detailed and it is evident that in this case likewise copulation took place without swarming. I shall treat of this article more at length in another place.

Perhaps the earliest definite record of mosquitoes swarming is that by Swinton, published in 1798. Swinton describes some swarms which he, together with a friend, witnessed on August 20, 1766, in a garden at Oxford. The account has been drawn upon by later writers but I quote it here as it brings out very clearly the habit of congregating over prominent objects. There can be little doubt that the swarms in question were Culices as Swinton especially remarks upon the great annoyance caused that season by the bites of the unusually abundant "gnats." He relates that "about half an hour before sunset, such an immense number of gnats filled the atmosphere in which we breathe, as I had never seen before. We both of us also then observed six columns, formed intirely of these insects, ascending from the tops of six boughs of an apple-tree, * * * to the height of at least fifty or sixty feet. Two of these columns seemed perfectly erect and perpendicular, three of them oblique, and one approached somewhat towards a pyramidal form." He further relates that other swarms were seen in the vicinity on the same evening. In conclusion he states: "I have been informed by the Reverend Dr. Wyndham, Warden of Wadham College in this University, that, about thirty years ago, many columns of gnats were perceived to rise from the top of the steeple of the cathedral church at Salisbury, by a considerable number of people. He likewise declared, that these columns were seen both by himself and the Reverend Dr. John Clarke, then Dean of Salisbury; that, at a small distance, they resembled smoke; and that this at first occasioned a sort of alarm, many believing that the church was on fire."

There are a number of accounts of such swarms about church steeples causing alarm of fire. We have them from Germar (1813), Boll, Kirby and Spence, and Hagen. Boll records three such swarms. One of them on the steeple of the Nicolai church in Hamburg took place on a June evening at nine oclock. The discovery of the true nature of the apparent smoke, after the fire-department had been called to the spot, caused great merriment in the crowd of spectators. In 1807, when the St. Mary's church in Neubrandenburg served as a powder magazine, the sudden news that the steeple was on fire caused many of the inhabitants to flee precipitately from the city. As the column of smoke about the steeple did not increase, some courageous men finally ventured onto the tower and discovered that the source of alarm was an immense swarm of gnats. Another swarm was observed about the cross of this same church-steeple, at a height of 300 feet, on the afternoon of August 20, 1859. Hagen relates that dense swarms of gnats about the church-steeple at Fischhausen caused an alarm of fire which has earned for the inhabitants the nickname of "Mückenpeitscher." Koch has reported a swarm from the wings of a windmill, at a height of perhaps a hundred feet from the ground, curled by the breeze and resembling smoke.

Haliday states that *Culex detritus** occurs at Holywood, County Down, "in multitudes, during the day among hedges on the seacoast, in the evening in columns about the tops of trees, appearing like smoke at the distance of a furlong." Weyenbergh records two swarms of *Culex pipiens* from the vicinity of Haarlem, observed in 1857, dancing in perpendicular columns.

Mott gives an interesting account of an unusual gathering of gnats observed by him in 1879. As the article is not generally accessible and describes well the phenomenon, I quote it nearly in full. "On the evening of September 1st, between six and seven, after a fine, sunny day, the sky being clear, and the full moon just rising as the sun went down there was a grand festival among the gnats. Above the tops of the trees and hedge-rows in the low meadows north of Leicester these little Diptera were out in immense numbers. * * They assembled in groups of various shapes, sometimes a vertical column from 6 ft. to 20 ft. high, and 1 ft. to 3 ft. diameter, rose from a tree top like a pillar of smoke. Sometimes a sheet 4 ft. or 5 ft. high and 10 ft. long hung above the hedgerow, but seemed never more than a foot or so in thickness. The following evening, at the same hour, the sky being more clouded, a few gnats only were to be seen; but on the evening of the 6th, with the sky again cloudy, there was a still more remarkable display of gnat life. The little creatures were out again in millions, but this time the vertical column formation was adopted by nearly the whole of them. These columns rose from the hedges on either side of the road, and were visible for half a mile a-head at irregular distances, averaging, perhaps, 21 ft. or 15 ft. They formed an avenue of such a singular and unusual appearance that everyone who passed along the road paused at intervals to watch and wonder at them. This piece of road is about half a mile long, on the top of an embankment which carries it over the low meadows and the river. At the farther end there are a number of trees, and from the top of nearly every tree three or four of the strange, smokelike columns could be seen standing up in the air, always straight but not always vertical, some of them being inclined at small angles. * * * On watching one of the columns closely, it was apparent that all the gnats had their heads one way, facing the breeze, which, however, was a very light one. It was a calm evening; what air-current there was came from the south-east. It seemed to be sufficient occasionally to press back the column a few inches from its normal position, and whenever this happened the whole body of gnats jerked themselves forward again with one perfectly synchronous impulse."

A picturesque account of a remarkable swarming of Culices, at Lewisham Road

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*Haliday's *Culex detritus* greatly resembles the common *Culex pipiens* and most probably the observation should be credited to the latter species.

near London, is given by Douglas. During ten days he observed "the air thick with millions of them, at times charging in close column up the road, like a squadron of cavalry, at other times engaged in dancing up and down, after the manner of their race." These swarms were in evidence only during the hour before dark and it appears were over or near the road, within reach of the riding whips and sticks of the "*profanum vulgus*." Near by "are several tall trees, and round the top of the highest one only, at the same hour of the evening that the periodical saltatory performances are going on in the road, enormous swarms of gnats congregate. At first they appear as a small black cloud curling about the ends of the branches, and soon, when the air is calm, rising in a close column, like smoke from a chimney, for a distance of some 20 or 30 feet, the bulk gradually becoming more grey and attenuated until lost to sight in the upward progress. When a breeze is moving, the insects, always preserving close order, are blown out laterally, and after skirmishing with the wind return to their cover among the top leaves of the tree." This last remark may be an assumption and at such distance from the ground could hardly have been based upon actual observation. Douglas suspects that the species in the tree was "not the same as that of the acrobats of the road," and with right; unfortunately neither form was definitely identified. It further appears from the remarks of Douglas that these swarms are an annual occurrence, only that the number of individuals varies greatly from year to year.

In all the foregoing notes the writers failed to notice the true function of these gatherings of Nemocera. However it had not escaped that keen observer Gilbert White. He was evidently uncertain of the identity of the insects concerned, for in his posthumously published notes he calls them "*empedes* or *tipulae*." Speaking of their swarms at evening he says: "At this juncture they sport and copulate; as it grows more dark they retire. All day they hide in the hedges. As they rise in a cloud they appear like smoke." No further mention of copulation in connection with swarming appears until Taschenberg's popular account of *Culex pipiens*, published in 1882. He notes their habit of gathering at the gables of houses and other prominences and describes how the females fly to the swarm of males to effect copulation. In the notes on the swarming of Chironomidae which follow, Taschenberg describes the formation over trees and in tall columns, and we are left to infer that the *Culex* swarms do not assume the columnar form — at least not in the same degree.

Theobald's brief, disjointed notes on the pairing and swarming of mosquitoes would hardly convey the correct impression to the lay mind. He corroborates Taschenberg's statement that in *Culex pipiens* the females fly to the males to copulate but he failed to note that the males congregate about prominent objects. The brief remarks on the swarming of *Culex cantans*, observed twice by Theobald in the fens, shows a distinct mode of swarming in this species. These swarms, composed of both sexes, formed dense clouds which quite darkened the air. "These insect-clouds were constantly moving up and down about ten to twelve feet above the ground. At times the noise they produced could be heard a quarter of a mile off, then it would suddenly cease for some time and commence again." It is to be supposed that Mr. Theobald is not to be taken literally when he says the insect clouds were constantly moving up and down but that the motion applies to the individuals in the swarms, as in the foregoing observations.

Radl has written two most interesting and suggestive papers on the light-reactions of Arthropods and a great part of his discussion is based on the behavior of swarming insects, particularly of Culicids and Chironomids. It would lead too far to enter into a discussion of these papers, but the fact is brought out that these insects orient themselves towards some definite object which is differentiated from its surroundings either by greater prominence or a difference in color. He not only cites instances of orientation towards trees, bushes, sign-posts, or even heads of grass, but others where the swarms hovered over paths through fields, or spots of different color but not elevated above the surroundings. The swarms over spots on the ground in all probability belong to different species from those attracted to prominent objects. Radl confesses that he made no attempt at close determination of the insects under observation and it is evident that he had no conception of the number of forms of similar but distinct habits that he might have before him. In consequence his statements are far too general and much that might have been used for or against his contention has escaped him.

Little as we yet know of the subject, it will be well to state right here that, even within the Culicidae, there is not only a marked diversity in the mode of swarming of different species, but that there are many forms which do not swarm at all. In the case of the almost exclusively house-inhabiting *Stegomyia calopus*, as Goeldi has shown, there are no such swarms as in *Culex* proper. The males congregate in little groups of 15 or 20, hovering over the corner of a cabinet or other prominent object, and pounce upon the females that come within range. I can add that copulation frequently takes place when there is no evidence of even such weak swarms. It should be noted that in *Stegomyia* copulation takes place during the brightest part of the day. On the other hand I have upon two occasions observed small swarms of *Stegomyia* (presumably males) hovering over the heads of persons, in both cases shortly before sunset. Once this occurred upon the hotel-veranda at Cordoba, Mexico, and again in the street at Acapulco, over the heads of passers and keeping along with them. In this case the meaning of the swarms would be hard to interpret.

Upon a recent trip to the west coast Dr. H. G. Dyar found a pair of *Culiseta consobrinus* in copula, resting on the under side of a board. This observation shows a wide departure from the short copulatory act of *Culex* and *Stegomyia*.

The crab-hole inhabiting *Deinocerites cancer* swarms during the short twilight period just outside the crab-holes and copulation takes place then.

Goeldi has given a vivid account of the swarming of the common house-mosquito of Pará which he designates as *Culex fatigans*. Swarming takes place indoors when it is nearly or quite dark and there are separate swarms of males and of females. Such peculiar mating-habits surely indicate a distinct species. In the case of our *Culex pipiens* the males are never found in houses — unless, indeed, they happen to come from larvae developed indoors.

Mr. E. A. Schwarz has kindly placed at my disposal his observations made on a species of *Culex*, probably the *Culex cubensis* of Bigot, at Cayamas in Cuba. The swarming occurred in the house, always on the side away from the sun, and when it was almost fully dark. The mosquitoes could only be seen against the sky, when between the observer and the open doors and windows and close observation was impossible under the circumstances. However, the swarms in this case were made up of both sexes and copulation freely took place. A capture of 60 specimens from such a swarm contains 44 males and 16 females.

In conclusion the curious reaction of a mosquito swarm to sound, related to Osten Sacken by a Cuban naturalist, seems worthy of notice. While a swarm of mosquitoes was hovering over the head of the observer a band was playing at a distance. Whenever the note A was struck the mosquitoes were all precipitated downward, striking against the face of the observer. A similar and quite independent observation is recorded by Howard.

The bringing together of these notes shows how very meagre our knowledge of this interesting subject is and it is to be hoped that it will stimulate others to further observations. No claim of completeness is made for the following bibliography. The works not seen by the writer are indicated with an *.

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EASTERN MASS. MOTHS WANTED in exchange for same. Also, reliable colored sketches of larvae of same. C. V. Blackburn, 101 Pine St., Woburn, Mass.

Am willing to make contracts to collect for the season, with private collectors, museums, colleges or any public institution for insects of any order or group desired, either in large or small series. Duplicates of all orders for sale from Colorado, New Mexico, and Arizona. Correspondence solicited. Ernest J. Oslar, 4535 Raleigh St. Alcott P. O., Denver, Colorado.

WANTED—Records of captures of Connecticut insects—especially the rarer species—for the preparation of a State list. Orthoptera and Hymenoptera records desired at once. W. E. Britton, State Entomologist, New Haven, Conn.

CICINDELIDAE of the world wanted. Good exchange in all families of Coleoptera offered. H. F. Wickham, Iowa City, Iowa, U. S. A.

HIPPODAMIA—Live individuals and large masses for variation study desired. Insects collected to order in exchange. The following species especially wanted—H. moesta, 12-maculata and sinuata. R. H. Johnson, Station for Experimental Evolution, Cold Spring Harbor, N. Y.

TO ALL INTERESTED IN ENTOMOLOGY.

The initial meeting of The Entomological Society of America will be held in New York City in connection with the midwinter meetings of the American Association for the Advancement of Science.

This society has been organized to meet the need of a national entomological society which shall represent all departments of entomology, and which shall hold a place in American entomology similar to that held in their respective countries by the great foreign entomological societies.

It is hoped that this movement will have the cooperation of all of the existing entomological societies in this country and that it will in no way interfere with the success of any of them. It is believed that a strong national society which shall bring together workers in all fields of entomology will tend to broaden the interests of each, and to strengthen the more special or local societies.

The amount of entomological work that is being done in the United States and Canada is great compared with what is being done in any other country; it is fitting, therefore, that the workers in this field should be united in a national society.

On another page there is given the report of the committee on organization; and an invitation is hereby extended to every one interested in entomology to join the society. Applications for membership may be addressed to J. H. Comstock, Ithaca, New York.

MELANOPLUS VIRIDIPES IN NEW ENGLAND.

This is the latest addition to the orthopterous fauna of New England. On June 14 Mr. C. W. Johnson took four examples, all males, at North Adams, Mass., at elevations of 1100 to 1400 feet on the foothills of Mt. Greylock. They were found resting on bushes in highland pastures and by the roadside.

This species has not been previously reported from east of Ohio. It matures very early, in June or possibly the latter part of May, and perhaps this is one reason why it has not been noticed before.

A. P. Morse.

THE PATTERN VARIATION IN THE PUPA OF *MELITAEA CHALCEDON*.— PLATE VIII.

BY LILIAN RAMSAY, STANFORD UNIVERSITY, CAL.

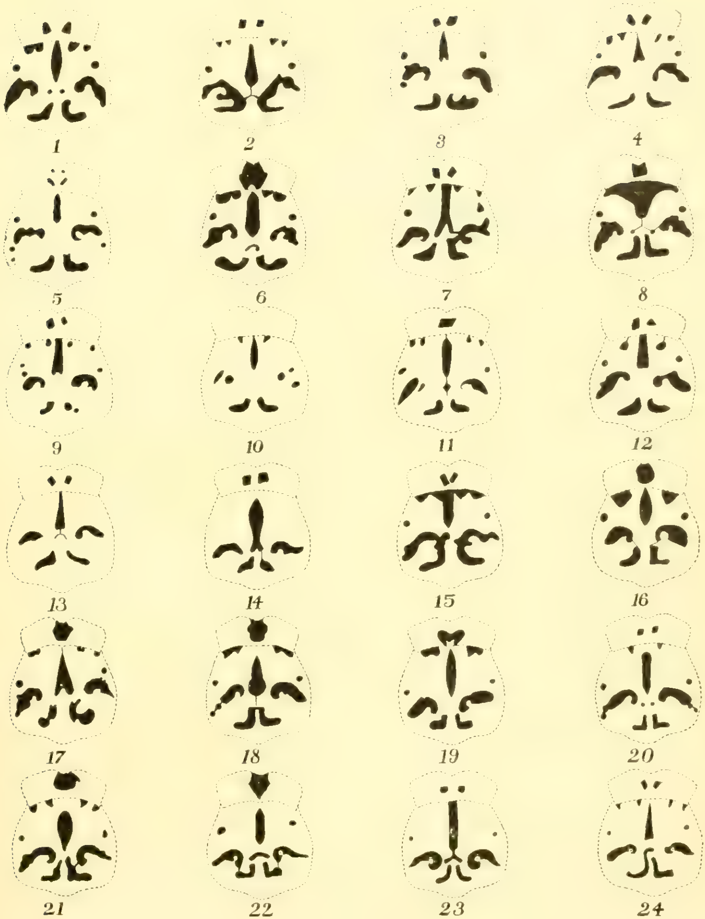
VARIATION in color pattern is familiar among adult insects. If color pattern is of advantage in the way of aiding insects, by protective resemblance, mimicry, warning, recognition, etc., in the struggle for existence, variations in the pattern are the material seized on by natural selection upon which new types of pattern and ultimately new species are built. That is, this is true if the natural selection theory of species-forming is true.

But insects have a struggle for existence in their immature stages as well as in adult condition and these young stages must be protected as well as the imaginal life. Are variations as numerous and as marked in immature characters as in adult ones? The assumption is, of course, that they are, but as a matter of fact there seem to be few specific proofs of this recorded in the large and rapidly growing literature of variation. As a simple contribution of definite data of variation in an immature character, I present the following brief statement and plate showing the variation in the pattern (black markings on a gray-green ground) of the antero-ventral half of the naked pupa of the checker spot butterfly, *Melitaea Chalcedon*.

The series examined included 127 pupae (chrysalids) obtained from as many nearly full-grown larvae collected at one time in one place on the University campus and reared to pupation in the laboratory. All the larvae were enclosed in a single breeding cage and hence all pupated under identical environment. The variations may be looked on therefore as blastogenic in character.

No two of the chrysalids have exactly the same markings. The pattern variation is typically continuous or gradatory, any two types being perfectly connected by gradatory inter-types. Hence no statistical tabulation of the variation can be made. The twenty-four types figured represent the range of variation and to some one of them can be referred approximately any chrysalid examined. But actually each figure represents accurately the pattern of only one particular specimen. The modal pattern is plainly of the type with numerous large strong blotches, like figs. 8, 16, 6 and the like, rather than of the less strongly marked type, as exemplified by figs. 23, 10, 13 and the like.

As these pupae are naked and wholly exposed to discovery by roving enemies they must depend largely for protection on a dissimulating color pattern. The variation in this color pattern must belong therefore distinctly to the class of slight, continuous variations that offer themselves as 'handles' for natural selection: that is, they must if any such class really exists.



Diagrammatic representation of variations in the color-pattern of the antero-ventral aspect of the naked chrysalid of the checker-spot butterfly, *Melitaea chalcedon*.

TRICHOGRAMMA PRETIOSA RILEY. OVIPOSITION, —A RÉSUMÉ.

ALEC. ARSÈNE GIRAULT, WASHINGTON, D. C.

LINTNER (1883), in Psyche, has given an accurate and somewhat detailed account of the oviposition of this minute and very interesting egg-parasite, which has also been copied *verbatim* in his second report on the injurious and other insects of the state of New York (Lintner, 1885). The host was *Pteronus ribesii* Scopoli, formerly *Nematus ventricosus* Klug.

This is the first account of its oviposition published, and although lacking in many details, the best one so far placed on record. Others have observed and briefly recorded this habit. Riley (1885), quoting Hubbard, states briefly that the mother parasite works chiefly by day, depositing two ova in each egg of *Alabama* or *Heliothis*; often, but a single adult emerged from the host eggs, and occasionally three were obtained. Nothing is said in regard to the manner of oviposition. F. W. Mally (1902), briefly states the manner of oviposition, with some details; probably he had not seen Lintner's account. The host was *Heliothis obsoleta* Fabricius, and the account is accurate so far as given. Finally, Quaintance and Brues (1905), give a brief, condensed account of its oviposition, as a result of recent studies. The following is but an enlargement of their account.

During the recent investigations on the cotton bollworm (*Heliothis obsoleta* Fabr.) by the United States Department of Agriculture, in Texas, during 1904 the writer had occasion, in studying its parasites in the laboratory at Paris, to make detailed studies on this species of *Trichogramma*, the most common and useful of the many parasites attacking that important pest. Hundreds of specimens were reared in confinement, and ample opportunity offered to observe its habits closely. As shown below, specimens were placed on the stage of the microscope, and there watched at leisure, while they ran busily about among the host eggs, depositing into them.

These observations but serve to confirm those made by Lintner; and it is through the kindness of Dr. L. O. Howard, Chief of the Bureau of Entomology, that the writer is able to offer these more detailed notes on this little egg-parasite. They are also offered as an addition to our knowledge of the habits of the smaller parasitic Hymenoptera, and to sum up, as it were, what is now known in regard to the oviposition-habit of *pretiosa*. Further results of the studies on this insect will be offered as time permits.

1. *General manner of oviposition.* This has been aptly described by Lintner (1883); details are here added.

Females taken from jars in which confined, several hours after emergence, were transferred by means of a camel's hair brush to a portion of a blade of corn upon which had been deposited, thickly, eggs of *Heliothis*, by moths also in confinement. The blade of corn was then placed on the stage of the microscope, and the insects watched, while they deposited egg after egg. These observations were repeated from time to time, with and without the aid of the microscope. The latter, however, was necessary, on account of the microscopic size of the insect.

When placed on the leaf of corn, the insects immediately began to crawl rapidly about, showing no indications that they were aware of the presence of suitable hosts, until they chanced upon one. At this, the female stopped and sensed the egg with its antennae, recognizing it. Searching is evidently the only way in which the insect finds its hosts, and in nature they doubtless travel many hours, at times, before finding a suitable place in which to deposit their eggs. After stopping and recognizing the host, and satisfying itself of its suitability, the female crawls upon it, and begins a minute, though rapid, examination of its surface with the brush-like clubs of the antennae, travelling generally, when doing this, transversely around the egg in a direction perpendicular to the polar ridges, and taking a variable, though short, period of time.

Becoming suddenly satisfied, she stops short, advances the length of her body, and raising the latter, applies the point of the ovipositor to the spot last sensed by the antennae. The tip of the abdomen now forms a caudal support, and the legs are well out and propped. Thus gripping the host egg, pressure is brought to bear on the ovipositor, which being resisted by the tough chorion, now bends and twists like a good rapier, which it much resembles in miniature. The parasite is now trying to force the ovipositor into the egg. In this it often fails (cf. 6), though generally successful. After its point has pierced the chorion, the ovipositor is slowly and firmly pushed in to its entire length, which is about half of the greatest diameter of the host egg, about 0.24 mm., or until the ventum of the female is in contact with the surface of the host.

Slight spasmodic contractions of the abdomen then ensue, doubtless sending the egg through the oviduct and ovipositor into the host, where it is deposited centrally. The ovipositor is then as slowly withdrawn, the female arching its abdomen very high, almost straining, until it is entirely out, when she regains her feet, and darts off in search of another egg, or simply changes position on the same egg, and repeats the operation; or else rests, according to circumstances. After beginning to insert the ovipositor, the antennae become non-vibratile, lying against the face; and in some observed cases, just as the ovipositor was wholly within the egg, the wings were lifted straight up over the body, perhaps to help in preserving a balance. The ovipositor is inserted always between the polar ridges on the host egg.

While engaged in oviposition, the female is very intent on her work, and is not easily disturbed. Indeed, large things do not seem to frighten or annoy these minute parasites, and no indication is given that they are aware of the presence of an observer, even when this presence is forced upon them. When they are sufficiently disturbed, however, they remain perfectly motionless, very seldom resorting to flight. On account of this apparent nonchalance, they are, in spite of their minuteness, very easy to breed.

2. *Oviposition in regard to time.* The time taken for single depositions averages about two (2) minutes, and is fairly constant in a large number of cases. The following observations were made on this point.

On June fourth, at 3 P. M., four females and one male, issuing from host eggs during the morning of the same day, were confined beneath a large bell-jar of convenient size, with eighty-one (81) fresh ova of *obsoleta* deposited in confinement during the afternoon and evening of June third, on a large piece of bristol-board. The latter was simply covered by the jar and the parasites then introduced.

After crawling about for several minutes, two (2) of the females found the eggs, and without hesitation, began to oviposit. They were so intent on their work, that the jar was removed and the individuals closely watched for a period covering two hours. This whole time they made no attempts whatever to escape, even showing no disposition to do so. They were so absorbed, indeed, that the piece of bristol-board was cut to a convenient size with a pair of scissors, and moved about freely, most of the time being on the stage of the microscope.

Oviposition was almost continuous for the first half-hour (3.00-3.30 P. M.), both females working actively. Then the paper was moved to the stage of the microscope. The parasites became perfectly motionless when this movement was made, remaining in their respective positions for another half-hour, doubtless, at first, slightly annoyed. At 4 P. M., one again began to oviposit, and soon the other joined her, though both showed tendencies to wander, or rest, and seemed to be more or less jaded. They continued thus until 5 P. M., when observations were suspended.

During the first half-hour, observations were made with a hand lens (aplanatic, triplet, ½-inch, Bausch and Lomb), but the latter was then discarded because the ovipositor, though visible, was difficult to follow, and the time of oviposition had to be judged in most cases by the movements of the insect. Hence, the time varied considerably as may be expected. The range was from fifteen (15) to one hundred and fifty (150) seconds, the smaller time-periods doubtless due to the fact that mere attempts to oviposit were mistaken for accomplishments of the act itself. With the lens, the following periods of time were obtained.

Deposition number.	Time, seconds.
1.	70.
2.	115.
3.	80.
4.	80.
5.	15.
6.	15.
7.	15.
8.	25.
9.	120.
10.	150.
10.	85.6, avg.

Observations with the microscope were made with the ⅔-inch objective, Bausch and Lomb, which was admirably fitted for the purpose. Every movement of the insect could be plainly seen, and therefore the time for each deposition could be accurately measured. The following time is to be accepted as that which is correct, obtained from many subsequent observations. The time was taken from the beginning of the insertion of the ovipositor.

Deposition number.	Time, seconds.
1.	120.
2.	120.
3.	150.
3.	130., avg.

From this, it is safe to say that two (2) minutes, more or less, is the average time taken to deposit a single egg. Individual differences cause the variation. From fifteen (15) to forty-five (45) seconds is normally required for insertion of the long ovipositor. (Vide seq., 6.)

3. *Faulty instinct.* This is doubtless present in some form in all insects. In *Trichogramma pretiosa,* when in confinement, some very interesting observations were made on this.

On the fourteenth of June, a single female without hesitation, oviposited twenty (20) times into infertile host eggs which were supplied her (Vide seq., 6). The eggs of the parasite hatched, and a generation successfully developed in these infertile ova. This being the case, it is doubtful whether or not this oviposition was due to faulty instinct, although the parasite was, seemingly, not conscious that the hosts were infertile. The fact is a very interesting one. It is worthy of note that these infertile eggs when thus parasitized, did not shrivel at all, but remained as full in appearance as fertile and normally developing eggs. The checks, however, shriveled completely.

On the first of October, a tenth reared generation of *Trichogramma* was obtained from infertile hosts under similar conditions.

On the morning of the twenty-fifth of June, the last of the newly emerged females of the third reared generation were found still wandering about the bell-jar under which confined, in search of fresh hosts in which to deposit; as there were only eleven (11) of the latter present, not already blackened by parasitism, it was highly probable that all of them had been deposited into.

In spite of this, the females were ovipositing continuously, refusing, in every case observed, the blackened hosts. To the contrary, depositing from three to five (3–5) times in the yet pale hosts. At times, these were refused.

In one of these pale eggs (which as stated, were also evidently parasitized but not yet blackened) which had been isolated, a female deposited about four (4) times; this egg turned black two (2) hours afterwards, proving beyond doubt that that female had oviposited into a host already parasitized about forty-eight (48) hours previously, as the black color does not appear until after the parasite's egg hatches, at this time of the year, slightly under three (3) days. It is probable that some of the pale eggs were not parasitized.

Hence, apparently, the female recognizes hosts which have already been deposited into, not until they have blackened, or by their color.

4. *Number of eggs deposited*; *calculation of the possible maximum number deposited*. The highest number of eggs observed to be laid was thirty-three (33). On the twenty-seventh of September, a single female issuing from *obsoleta* eggs collected on corn, in a small glass vial, at 3.40 P. M., was at once confined in another glass vial, closely stoppered, with portions of cotton leaves containing many ripe host eggs. She oviposited as follows.

Host number.	Time, P. M.	Number depositions per egg.
1.	3:46	1; 1; 1 (4:59); 1 (5:02).
2.	3:52:30.	1; 1 (4:58); 1 (5:10); 1 (5:12).
3.	3:54–3:55:30.	1; 1 (5:40).
4.	3:56:30	1.
5.	3:58.	1; 1.
6.	4:00.	1.
7.	4:05:30.	1.
8.	4:50–4:54.	1; 1.
9.	4:57.	1; 1; 1; 1; 1;
10.	5:13.	1; 1 (5:43).
11.	5:17.	1; 1.
12.	5:20.	1; 1 (6:05); 1 (6:10).
13.	5:25–5:27	1; 1.
14.	6:20.	1; 1. Final observation.

On July first, twenty-two (22) parasites emerged from hosts exposed to a single female; she therefore deposited at least twenty-two (22) eggs.

For other important observations on this, vide seq., 6.

From the fact that these observations were made under artificial conditions, that is, that the host eggs were supplied gratuitously, the female not having to search for them as they occur in nature, it is rather difficult to base calculations upon them. However, the following calculation is based on several apparent facts,— that the average time for single depositions is two minutes; and that, after females had been laying eggs continuously for a half-hour they appeared to be more or less exhausted, and deposition occurred at intervals of time only thereafter, for the space of about two hours. Hence the period of oviposition appears to be at its height during the first half-hour after commencement, and continues with more or less persistency for about two hours.

Without going into details, the average number of eggs for two hours would be sixty (60) eggs; and for one-half hour, fifteen (15) eggs. This calculation agrees with conditions found in confinement. Two females in the time of two hours, parasitized twenty-four (24) eggs, out of many supplied, averaging three depositions to a host. This would make thirty-six (36) eggs deposited by each. Repeated observations seemingly confirm this, and indicate forty (40) eggs, or less, as the average number deposited.

A calculation of the possible, but improbable and obviously absurd, maximum number of eggs laid, leads to the enormous number of one thousand and eighty (1,080). The average length of life of a female was here limited to two days, the average length of the period of oviposition to thirty-six hours, and the average time for single depositions to two minutes.

It is important to take into consideration the fact that in nature the host eggs are well scattered, and that the little *Trichogramma* has to take considerable time and much pains to find them. For such a minute insect, the examination of a whole leaf of corn is no small undertaking.

5. *Number of eggs deposited into single hosts.* This was determined both by direct observation and by rearing experiments.

By direct observation, much data was obtained but was hardly worthy because of the conditions prevailing in confinement. Females were observed several times to deposit as many as five eggs into a single host, but all of these did not successfully develop.

On this point, the following results were obtained by rearing experiments made in the laboratory at Paris. The hosts were obtained from corn and cotton.

Date, 1904.	*Host No.*	*Number parasites emerging.*
May 6th.	1.	4.
May 15th.	2.	3.
	3.	3.
May 16th.	4.	4.
	5.	1.
	6.	1.
	7.	2.
	8.	5.
	9.	3.
	10.	2.
	11.	4.
	12.	4.
	13.	2.
	14.	2.
	15.	3.
	16.	4.
	17.	5.
May 31st.	18.	1.
	19.	4.

Date, 1904	*Host No.*	*Number parasites emerging.*
May 31st.	20.	3.
	21.	4.
	22.	1.
	23.	4.
	24.	3.
June 12th.	25.	2.
June 27th.	26.	4.
July 23rd.	27.	2.
	28.	2.
	29.	2.
	30.	1.
	31.	2.
	32.	1.
July 30th.	33.	3.
	34.	4.
	35.	3.
	36.	3.
	37.	3.
	38.	1.
October 18th.	39.	3.
	40.	3.
Totals.	40.	111.

Average, 3.

It is thus seen that the number of adults issuing from a single host is not constant, but varies from one to five, averaging from two to three. The number also doubtless varies according to the species of host.

6. *Observations on a single female, bearing on the foregoing.* The following notes are derived from observations made on a single female, supposedly virgin, emerging from an egg of *Heliothis* between the hours of 12:30 and 2 P. M., June 14. The observations continued until 6:35 P. M., when the insect escaped.

a. *Faulty instinct.* At 3:30 P. M., the glass jar containing this female was lifted and the insect transferred by means of a camel's hair brush, to a portion of a corn leaf on which had been deposited thirty-four (34) sterile host eggs. The leaf was transferred to a slide, and then placed on the stage of the microscope (⅔-inch objective, Bausch and Lomb).

It crawled about, not in the least disturbed, and soon found the hosts. At exactly 3:33, oviposition began, or about one and one-half hours after birth. There were no indications to show that she was in any way conscious that the hosts were infertile.

Table showing activity in regard to oviposition.

Oviposition from	Resting periods	Number eggs deposited
3:33–3:47	3:47–3:48	
3:48–3:55	3:55–4:12	11 eggs.
4:12–4:27	4:27–4:35	3
4:35–4:44	4:44–5:40	3
5:40–5:42	5:42–6:08:30	1
6:08:30–6:18	6:18–6:35	2
Totals. 56½ minutes	125½ minutes.	20 eggs.

b. *Number of eggs deposited*; *number of depositions in single hosts.* The actual number of eggs deposited by this female, as shown above is twenty (20). Most of them were deposited during the first hour of the whole time during which the female was under observation, showing, or at least indicating, that by this time the insect was well tired out. This condition may have been brought on by the difficulty in this case experienced in inserting the ovipositor:

From 4:12–4:27 P. M., a period of activity as given in foregoing, the female, after depositing a single egg, made 17 futile attempts in succession to insert the ovipositor in as many places in the same host. Each attempt occupied from 15–35 seconds. Two successful depositions then occurred, followed by a period of 7 minutes rest, when another active period of 8 minutes ensued, during which, after depositing another egg, 3 more successive futile attempts to insert the ovipositor were made, all on the same host. Two successful depositions were then made in a different host. After this oviposition became fitful, but three eggs being deposited in the remaining two hours.

The exact cause of this inability to insert the ovipositor could not be ascertained from the nature of the case, but it was probably caused by weakness. The point of the ovipositor did not slip about during these attempts.

Out of the thirty-four (34) host eggs, but ten (10) were parasitized by this female. Nine of these were noted with especial reference to the number of depositions made in each. In the first host, four eggs were deposited; in the 2nd, 3rd, and 4th, 3 eggs; in the 5th, 1 egg; in the 6th, 2 eggs; and in the 7th, 8th, and 9th, 1 egg. The average for each host is therefore about two (2).

c. *Oviposition in regard to time.* The following time periods for single depositions were noted during these observations.

Deposition number.	Time, seconds.
1.	70.
2.	138.
3.	96.
4.	90.
5.	134.
6.	85.
7.	105.
7.	103, avg.

7. "*Effective*" *oviposition.* The following interesting experiments were performed to find when, or if ever, there occurred a certain advanced period in the development of the host at which it was immune from the effects of the oviposition of the parasite, because of this advanced development. For instance, perfect embryos just before exclusion from the egg. Can these be effectually parasitized? The hosts used in these experiments were all deposited in confinement.

a. On the 26th of September, six hosts showing advanced signs of development, were exposed to two females of *pretiosa* in a small glass vial. They were deposited into, and the resulting parasites successfully developed. A check lot of eggs from the same source and of the same age, hatched eight (8) hours afterwards. So oviposition was effective up to within eight hours of the exclusion of the host.

b. Two females and one male of *pretiosa* issuing from a single host on the morning of September 26th, were confined in a small glass vial with a piece of a cotton leaf containing four ripe ova of *obsoleta*, deposited in confinement, and now showing very advanced signs of development. A control lot of hosts present.

At 10: 22 A. M., *pretiosa* began to oviposit into the hosts. One of the latter received four (4) of the parasitic eggs, the second, two (2) eggs, and the remaining two, an egg each, when at 10: 38 A. M. they were removed to a separate vial by themselves. By 8 P. M. the same day, the hosts were still more developed, the black head of the embryo perfectly visible through the shell. On the following morning they had not changed, and development had evidently been checked. During late P. M., September 28th, they turned completely black from the effects of the parasitization. Eight parasites emerged from these four hosts during early October. The control lot of hosts hatched at 5: 30 P. M., September 26th, or seven (7) hours afterwards. Hence, oviposition effective up to within seven hours of exclusion of the host.

c. A female of *pretiosa* confined at 3: 46 P. M., September 27th with nineteen (19) hosts, then hatching. Thirteen (13) of these hosts were successfully parasitized. A control lot of hosts hatching at 3 P. M., the same day. Hence oviposition effective up to within 4 or 5 hours, at the most, of exclusion of the host.

d. Five (5) hosts nearly ready to exclude, the perfect embryos visible, were exposed to a female parasite at 10: 15 A. M., September 28th. One of the hosts excluded at 10: 55 A. M. The other four (4) were blackened by the effects of parasitism by October first, or previously. These four yielded adult parasites later. Control lot of hosts excluding at 10 A. M., September 28th. Hence oviposition of *pretiosa* effective up to the moment of exclusion of the host.

These experiments strongly indicate that parasitization is successful up to the very moment of exclusion of the host, despite the fact that the perfect embryos of *obsoleta* are active and very capable of caring for themselves. They are not conclusive, however. Other experiments performed, indicate that when the host embryo is fully formed, parasitization is less successful than otherwise, doubtless due to the greater vitality of the embryo. Hence, there appears to be a certain period in the development of the host, the period between the perfect formation of the embryo and exclusion, in which it is partially, not totally, immune from attack.

8. *Length of the period of oviposition.* It was absolutely impossible to determine this under anything like natural conditions from the very nature of the case. From the evidence gathered in the laboratory, it is certain that the period of oviposition is very short, but it is not felt that this evidence warrants a statement of definite limits.

What conclusions are possible may be induced from what is said in regard to this matter on a previous page.

9. *Changes undergone by parasitized hosts.* After being parasitized, the host eggs retain their normal appearance, until the egg of the parasite hatches, when they become characteristically blackened, an opaque or dull bluish black. They still retain their normal shape and size, and the color persists indefinitely, always serving to distinguish eggs that have been parasitized. After the emergence of the resulting parasite or parasites, through a rounded hole in the side of the host egg, the color and shape still persist, and so on until the empty shell is destroyed through natural agencies. The black color comes on gradually, the host at first becoming dusky, finally opaque and black-blue. Infertile hosts are affected in the same way.

10. *Length of the egg instar.* If it is true that the black color of the host is due to the hatching of the parasite's egg, then the following table shows lengths of the period of incubation at different times of the season of 1904, as indicated by this

change in color. The periods are, of course, but approximately correct, and are probably worthless. It has been indicated, from time to time, that the period of incubation in *Trichogramma* is always several hours longer than that of the host, at any given date. By comparing the records for the periods of incubation of the latter as given by Quaintance and Brues (1905), page 52, and the table following, it is readily seen that this is not borne out by the facts.

TABLE OF THE EGG INSTARS AT DIFFERENT DATES, 1904.

Date hatched.	No. of observations	Length instar.		Date hatched.	No. of observations.	Length instar		Average.
		Days.	hrs.			Days.	hrs.	
May 30	6	3	5	Sept. 14	50	2	9	241 observa-
31	4	2	22	24	34	2	17	tions.
June 7	30	2	22	28	9	2	12	
16	14	2	16	Oct. 1	33	3	17	71 hours, or
17	3	2	13	5	5	3	18	2.95 days,
24	28	2	4	17	4	3	9	average.
25	9	2	14	19	12	4	0	

No records, unfortunately, were made during April, July and August, and late October.

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1885. Riley, Charles Valentine. Fourth report of the U. S. entomological commission, being a revised edition of bulletin No. 3, *etc*. U. S. Dep. Agric., Washington, p. 103.

1902. Mally, F. W. Report on the boll worm, Austin, Texas, p. 30. (Agric. and Mechanical College of Texas).

1905. Quaintance, Altus Lacy and Charles Thomas Brues. The cotton bollworm. Bull. No. 50, U. S. Dep. Agric., Bureau Ent., Washington, p. 117.

THE ENTOMOLOGICAL SOCIETY OF AMERICA.

A meeting of the committee to organize a national entomological society, for which provision was made at the Philadelphia meeting of the Entomological Club of the A. A. A. S., was held June 28, 1906, in the entomological laboratory of Cornell University. The New York Entomological Society was represented by Mr. Carl Schaeffer, the Chicago Entomological Society by Dr. James G. Needham, the Jugatae (the Ithaca Society) by Professor J. H. Comstock, the Newark Entomological Society by Mr. J. A. Grossbeck, the Entomological Society of Ontario by Rev. Professor C. J. S. Bethune, and the American Entomological Society by Mr. J. Chester Bradley. At an adjourned meeting the Washington Entomological Society was represented by Mr. E. S. G. Titus.

The committee was organized by the appointment of Professor Comstock as chairman and Mr. Bradley as secretary.

The secretary then stated in brief the history of the present movement for the organization of a national entomological society. The parts of Mr. Lyman's two Presidential Addresses dealing with the organization of an entomological union were read and discussed. Discussion then followed as to the purposes for which such a society should exist and as to whether there was need for one. The opinion that there was such a need seemed to prevail, but it was urged that if the society be formed it should be based on broad and comprehensive grounds. It was then moved that it is the sense of this committee that the organization of a national entomological society is desirable. Every member in turn was called upon for an expression of opinion, and every one spoke in favor of the organization; but it was the feeling of the committee that the success of such a society would depend on the securing of cooperation of other societies as the Association of Economic Entomologists and the Entomological Club of the A. A. A. S.

It was suggested that provision might advantageously be made for committees on policy, as on education, on legislation, on museum methods, and on nomenclature.

Strong opposition was made to the formation of any independent code for entomologists; but it was believed that a committee on nomenclature might have legitimate ground for existence in voicing the peculiar needs of entomology in matters of nomenclature and in securing their adequate representation in the International Zoological Congress.

A sub-committee was appointed to draft a constitution and by-laws, which should embody the decisions reached by the committee, and to report them at an adjourned meeting.

The committee then discussed membership, dues, officers, elections and other matters. The decisions concerning these were subsequently embodied in the constitution and by-laws. The committee then adjourned until the following day.

At an adjourned meeting held June 29, 1906, the report of the sub-committee on constitution and by-laws was read and discussed. After the making of some changes the report was adopted, and the sub-committee was authorized to prepare and have printed a report of the committee together with the Constitution and By-laws, and to send them with an invitation to be present at the initial meeting of the society, to every entomologist in the country whose address could be learned, and to have them published in the entomological journals. The sub-committee was also authorized to call an initial meeting in New York City in connection with the mid-winter meetings of the A. A. A. S., to make arrangements for that meeting, and to transact such other business as may be necessary.

At a second adjourned meeting held June 30, 1906, it was decided to apply at once for affiliation with the American Association for the Advancement of Science, and such application was subsequently made.

J. Chester Bradley, *Secretary.*

The Entomological Society of America.

CONSTITUTION.

Article I.

NAME.

Section 1. This organization shall be known as *The Entomological Society of America.*

Article II.

OBJECTS.

Section 1. It shall be the purpose of this society to promote the science of entomology in all its branches, to secure cooperation in all measures tending to that end, and to facilitate personal intercourse between entomologists.

Article III.

MEMBERSHIP.

Section 1. The active membership of this society shall consist of two classes: *members and fellows.*

SECTION 2. All persons interested in entomology shall be eligible to membership.

SECTION 3. Members who have contributed to the science of entomology in some important way may be elected fellows of the society. The number of fellows shall not exceed fifty at any time.

Article IV.

OFFICERS.

SECTION 1. The officers of the society shall be a President, two Vice-Presidents, and a Secretary-Treasurer. The duty of these officers shall be those usually pertaining to their respective offices.

SECTION 2. The business of the society not otherwise provided for shall be in the hands of an executive committee consisting of the officers named in Section 1 and six additional members, who shall be elected by the society. Four members of the committee shall constitute a quorum.

SECTION 3. The President shall represent the society upon the Council of the American Association for the Advancement of Science.*

Article V.

ELECTIONS.

SECTION 1. Election of Members. Nominations for membership may be made by any two members, and election shall be by Executive Committee.

SECTION 2. Election of Fellows. All nominations for fellows shall be signed by three or more members or fellows, and each nomination shall be accompanied by the following information concerning the nominee: name, address, occupation, branches of entomology engaged in, positions held involving entomological experience, entomological work done, and list of publications.

Election shall be by ballot at the annual meeting, upon nominations approved by the executive committee. Ballot may also be taken upon such other nominations, previously sent to the executive committee, as may be demanded by any five members or fellows. All elections of fellows shall require a two thirds vote of the members present.

SECTION 3. All officers shall be elected by ballot at the annual meeting, for a term of one year, and shall be eligible for re-election.

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* This section was adopted provisionally; it is to be included if affiliation with A. A. A. S. be granted.

Article VI.

MEETINGS.

SECTION 1. An annual meeting shall be held at such time and place as the Executive Committee each year may select.

Article VII.

AMENDMENTS.

SECTION 1. This constitution may be altered or amended at any annual meeting by a two thirds vote of the members present, a copy of each amendment proposed having been sent to members and fellows at least one month in advance of the meeting.

BY-LAWS.

1. The annual dues for members and fellows shall be one dollar.
2. A majority of the members present at an annual meeting shall constitute a quorum for the transaction of business.
3. Notice of all meetings of the society shall be sent to members at least one month in advance.
4. The Executive Committee shall provide a program for all meetings, including at the annual meeting, a popular lecture, and a technical entomological exhibit of material and methods.
5. The time of the business meeting shall be published prior to the opening session of the annual meeting.

THE GROWTH OF INSECT BIONOMICS.

The interesting suggestions for observation and collecting which are embodied in the now-issuing new edition (third) of the "Anleitung zu Wissenschaftlichen Beobachtungen Auf Reisen" edited by Professor von Neumayer do not, I am glad to notice, omit attention to the ethologic or bionomic aspect of natural history. In the chapter given to Arthropods, revised by Dr. L. Reh, section *H*, devoted to special hints for observation, is composed of a series of most suggestive paragraphs successively entitled polymorphism, parthenogenesis, varieties, protective resemblance, mimicry, terrifying means, weapons, death-feigning, autotomy, regeneration, directive marks, interrelations with other animals, parasitism, plant injuries, galls, etc., benefits and injuries to man, pollination of flowers, care of the young, instincts, special habits, etc., luminosity, and sound-making. In these paragraphs a glimpse is given of the fascination of the bionomic study of insects, and of the wonderful opportunities for illuminating new observations. Such observation or study need lack nothing of the exactness or detailed character of morphologic or systematic work. It is too commonly assumed that ecology, ethology, bionomics, etc., are synonyms for fads, for superficial observation and reckless generalization. In just so far as the study of insect bionomics is pursued carelessly it is worthless; pursued exhaustively, accurately and keenly it is immensely worth while. Folsom's book will help draw many entomologists into the alluring web of insect bionomic study. And this is a consummation devoutly to be wished. But don't give up the old habit of eye-straining exactness and utter fidelity to the minutiae of observation, as well as scientific caution in the formulation of generalizations.

Vernon L. Kellogg.

Stanford University, Calif.

SOME COMMON ERRORS IN THE NOMENCLATURE OF THE DIPTEROUS WING.

BY S. W. WILLISTON, CHICAGO, ILL.

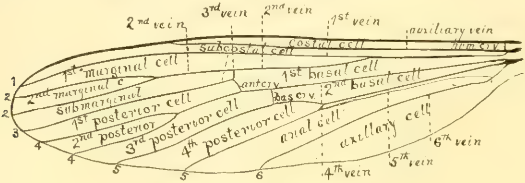
There are in common use two systems of nomenclature for the dipterous venation at the present time. A third, that proposed by Comstock and Needham, based upon comparative studies, has, so far, not received much approbation among students of the order.

The first and most commonly used of these systems is that given in detail by Loew in the first volume of the Monographs of North American Diptera; the second that adopted by Schiner in his later writings, and, since his time, by Wulp and Verrall especially, as also several other recent writers. Neither of these was the creation of the writers. That given by Loew was merely a codification of the usages of many of the early writers, especially Meigen and Wiedemann, with some additions and modifications proposed by himself. Schiner's system, likewise, was a rehabilitation, with modifications and additions, of the usages of various writers, notably the English, with some terms of the earlier continental entomologists. Loew's terminology was based chiefly upon the muscid venation, which he seemed to look upon as the more typical and primitive; he never attempted to apply his terminology to the nemocerous venation; in fact Loew never took enthusiastically to this division of the diptera. Schiner's system also was more especially applied to the brachycerous and muscid types, though he did attempt to homologize it with the nemocerous venation.

The application of neither system to the Nemocera has been altogether happy. Osten Sacken, when he came to use the Loewian nomenclature in the Tipulidae, was perplexed and led astray by some evident incongruities on Schiner's part, and his example has done more than that of any one else to perpetuate some very palpable errors, which, it seems to me, for the sake of consistency should be corrected — if either of these systems is to be used. Comstock and Needham did better, and their homologies are, for the most part, correct, I believe, though I am far from being assured that they have, in all cases, reached the correct conclusions, or that future researches will not modify the interpretations they have accepted for some of the diptera.

Schiner was the first to reach the conclusion that the 'fourth' longitudinal vein of the wing is the one which may be three-branched; and that the fifth is two-branched only. The hind branch of the fifth is the one which Loew called the 'posterior basal cross-vein', but in this Loew was very clearly wrong; this hind branch is not a cross-vein in any sense of the word, and few writers have made use of the term since his time. The vein closing the anal cell in the higher diptera should be known as the 'posterior branch of the fifth vein.' The anterior branch of this vein is the one bounding the fitfh posterior cell, when present, in front, and is always present as a discrete vein in those wings having a discal cell in the vein separating the last posterior cell from the second basal cell. The two branches of this vein are conspicuously evident of course in many of the Nemocera without discal cell. Comstock, agreeing with Schiner, believes that the fourth vein (Vein V) is primitively three-branched, the proximal branch enclosing the discal cell, and, in nearly all cases he assumes that when but a single branch of the fourth vein is present it is the proximal one; a belief with which I do not at all agree. It is a singular fact that no dipteron, (unless it be *Lonchoptera*) presents a simple three-branched fourth vein unconnected with the fifth, and I am myself inclined to the belief that it is the fifth vein which is normally three-branched and not the fourth; and that the discal cell, when present, is not due to the proximal branching, but rather to the presence of a true cross-vein separating the second basal from the discal cell. I of course have not had the opportunity to study the venation of other orders of insects as had Comstock and Needham, but so far as my studies go, I find no conclusive evidence in them. If the fourth vein is three branched and discal cell present, the vein separating the discal from the second basal is of course the first section of the proximal branch of the fourth vein; if the fifth vein is really the one that is three-branched, then this vein, at the outer end of the second basal, is always a true cross-vein, which it always is in the Comstock system when the discal cell is absent. Schiner it was who, very strangely for so acute an observer, gave to the short vein at the outer end of the second basal cell in the nemocera the name of posterior or great cross-vein, and Osten Sacken, perhaps led astray by his authority at a time when he had not given much thought to the brachycerous diptera, applied to the first section of the anterior branch of the fifth the name of 'great cross-vein' in the Tipulidae. The name 'posterior' or 'great' cross-vein is applied to the cross-vein closing the discal cell outwardly in all the muscid flies. Now it is very evident that the absence of a discal cell, in the mosquitoes for instance, is not due to the coalescence of the discal and second basal cells, but to the absence of the 'posterior cross-vein' of the muscid and brachycerous flies, and the application of this name to the vein at the inner end of the discal cell is very clearly incongruous. My attention to this incongruity was first fixed by the common usage among students of the Culicidae in calling the vein at the outer end of the second basal cell the 'posterior cross-vein,' when it is very evidently homologous with the inner vein only, the 'anterior basal cross-vein' of Loew, and that is the name that should be given to it, if we are to use these systems of nomenclature. A moment's consideration will convince the observer that the real posterior cross-vein of other flies is present only in the Tipulidae and Rhyphidae among nemocerous flies.

Again, in all the brachycerous flies that have the third vein furcate, the cells situated between the second vein and the posterior branch of the third are generally known as *submarginal* cells, either the 'inner' and 'outer' or first and second, and of course, as in *Hyperalonia*, the third and fourth sometimes; while the cell between the first and second vein is known as the *marginal* in the Loewian nomenclature. In the Nemocera again, misled by Osten Sacken's perplexities, the invariable usage is to call the cell formed by the furcation of the *second* vein the *first submarginal*. In the exceedingly rare instances (*Protoplasta*, etc.) in which the third vein is supposed to be furcate in the Tipulidae Osten Sacken gave the name of supernumerary first posterior cell to the second submarginal. The culicidologists speak of the 'first submarginal cell' as being longer or shorter than the second basal; what of course is meant is the 'second marginal cell.'



Venation of Culicidae.

It is rather a curious fact, for which I can offer no explanation, that the second vein is never furcate among brachycerous flies, while on the other hand the third vein is, I believe, never furcate among nemocerous flies, with the possible exception of *Protoplasta* and its allies and *Psychoda* and *Pericoma*. We find, it is true, an apparent anterior branch of the third vein in many Mycetophilidae, Bibionidae, etc. But, I believe that in every such case this so-called anterior branch is in reality the second vein, which is *always otherwise wanting in nemocerous flies having a so-called branch to the third vein*. Comstock's homologies are here also more correct than is the common usage. A good example of this shortened second vein will be found in *Paltostoma* among the Blepharoceridae, and indications also may be found among many of the Stratiomyidae, where the second vein confessedly has assumed the position of a branch of the third.

It is perhaps rather a bold opinion, but I am, nevertheless, inclined to it, that the Phoridae are really members of the Nemocera. The venation of the family is quite identical with that of *Aspistes* of the Bibionidae, for instance, and is easily explainable on this assumption, but utterly impossible from any other. The fact that the Phoridae have two-jointed palpi, while all the Cyclorrhapha have but a single joint, eliminates them I believe absolutely from membership in that group. The only diptera, aside from certain Nemocera, having two-jointed palpi, so far as my observation and reading go, are the Leptidae, Stratiomyidae, Tabanidae, Pantophthalmidae, Bombyliidae, some Asilidae, Apiocera and the Phoridae. I am not sure about the Empididae. The phorid antennae do not seem to me to offer insuperable objections to the location of the family among the Nemocera. So far as I am aware the first antennal joint in these flies is supposed to be absolutely wanting, the second much reduced in size. Assuming that the so-called third joint is in reality the second joint, it does not require much imagination to conceive that the, at least three-jointed, arista is in reality the whole flagellum of the Nemocera. And we have the Orphnephilidae to help us out in this assumption, where practically the only difference is that of additional aristal joints. Schiner seems to have had the same idea in his association of the Phoridae next to the Bibionidae in his Fauna Austriaca. On the other hand it is a well-known fact that the most primitive antennae of all diptera, so far as the number of distinct joints is concerned, with a few exceptions only among the Cecidomyidae, are found in the Brachycera, not the Nemocera! I may add by way of postscript, that Theobald's interpretation of the Culicid venation in his monograph is incorrect, and betrays a limited knowledge of the venation of allied diptera.

ANNOUNCEMENT CONCERNING INDEX TO PERIODICAL LITERATURE.

Subscribers who have followed the bibliographic references published in Psyche will notice the omission of this department from recent numbers. This omission does not mean that the work of collecting references has been abandoned, but simply indicates a change in practice made necessary by the increasing scope of the bibliography, which has outgrown the space available for printing it. It has seemed inadvisable to increase the proportion of space for such matter, since that would involve the crowding out of valuable articles, and only a few of Psyche's readers — those to whom other and more complete indexes are inaccessible — would gain thereby.

Henceforth, therefore, the Index to Periodical Literature will not be printed in Psyche; but it will be maintained, and *copies will be furnished without extra charge to paid-up subscribers requesting such service.*

It is believed that this new move will enable the journal to present more and lengthier original articles, and more illustrations, than before, while giving even prompter service in bibliographic work.

The Editors.

NEMOBIUS PALUSTRIS BLATCHLEY.

This species has not been reported from New England, but I find it common in the vicinity of Wellesley in suitable localities. I have Massachusetts specimens from Dover, Oct. 11; Natick, Oct. 16; Wellesley, Sept. 6, 27; and Connecticut examples from So. Kent and Canaan, Aug. 18 and 19. The latter were referred to *N. carolinus* by Scudder (Journ. N. Y. Ent. Soc., iv, 107–1896).

It is a tiny, shining dark brown or blackish species which lurks among the sphagnum moss of bogs and wet meadows and is common in suitable localities but captured with difficulty owing to its frailness and the character of its haunts. The most satisfactory method, after finding a station, is to spread the net and drive the crickets upon it.

Notes on its habits and habitats will be found in the Canadian Entomologist, xxxvi, 185 (1904) by Walker; and in the 27th Ann. Rept. Dept. Geol. Ind., p. 427, (1902) by Blatchley.

A. P. Morse.

THE DISTRIBUTION OF THE PERIODICAL CICADA IN NEW ENGLAND IN 1906.

IN New England the Periodical Cicada (*Tibicen septendecim*) of 1906, known as brood VIII (Marlatt) is confined to portions of Plymouth and Barnstable counties, Massachusetts. I have attempted to find out, as nearly as possible, the area occupied by this insect in the two counties. The most northern locality seems to be the Manomet Hills, or "Pine Hills" as they are locally called, about five miles southeast of Plymouth. This is the only record I have from Plymouth county. In Barnstable county, it is more widely distributed. Mr. Arthur A. Heald, Supt. of Public Schools, of Wareham, in a letter dated June 27, says: — "At present all that I can speak of with certainty are the towns of Sandwich, Mashpee, Bourne and Falmouth. Mr. Joseph A. Cushman found them very abundant at North Falmouth, June 15; they were also very plentiful at Cataumet and Pocasset. Miss Delia I. Griffin, Curator of the Fairbanks Museum, St. Johnsbury, Vermont, found it in great numbers in the woods near Osterville; this is the most easterly locality from which it has been reported. It made its appearance during the first week in June, the third being the first positive date I have of its emergence.

C. W. JOHNSON.

ERRATA.

In Mr. Knab's paper on Deinocerites cancer, published in PSYCHE, Vol. XIII, No. 4, August, 1906, the following corrections should be made:

p. 97, line 11 from top, after Dyar *insert* &.

p. 97, line 6 from bottom, for usually *read* unusually.

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THE SWARMING OF *ANOPHELES PUNCTIPENNIS* SAY.

BY FREDERICK KNAB, WASHINGTON, D. C.

UPON October 7 and 14 the writer observed the mating habits of *Anopheles punctipennis* and as, up to the present, nothing appears to have been made known regarding the mating habits in the genus *Anopheles*, the following notes are offered. Much to his surprise the writer found that the males of *Anopheles* swarm as do those of *Culex*, although the behavior in the two forms is quite different.

The observations were made on Plummers Island (Maryland) in the Potomac River, about ten miles above Washington. Near the highest part of the island is a ledge of rock forming an open space surrounded by the woods on three sides. The side towards the river is open, save for a couple of small trees at the edge, and terminates in a nearly perpendicular cliff. On October 7, shortly before 5 o'clock, the writer visited the spot to enjoy the sun-set. The ledge is about sixty feet above the water and on its highest part, where some tufts of tall grass grow in a crevice of the rock, was a swarm of dancing Diptera. The swarm was directly over the tufts of grass, its base seven or eight feet from the ground, the apex five or six feet higher. Although in appearance and action quite unlike *Culex pipiens* (observed on previous occasions) they were recognized as mosquitoes by the prominent palpi and the plumed antennae. With a sweep of the net fifteen were secured and proved to be males of *Anopheles punctipennis.* Their appearance in flight differed from *pipiens* mainly by the position of the legs which were held straight behind and close together. The palpi and antennae, directed straight forward, also appeared much more prominent than in *pipiens*, which, together with the much longer legs, extending out behind, gave them a very characteristic appearance.

In their actions, too, they differed markedly from *pipiens.* The swarm was small, composed of less than a hundred individuals, and was not as compact as the swarms of *pipiens.* The movements of these males were far more free and varied than those of *pipiens* which constantly repeat the same circumscribed movements. The *Anopheles* flew about in the swarm in a circling upward or downward "cork-screw" course. Their movements were more rapid than those of *pipiens* and often irregular; single individuals would at times leave the swarm, and cutting a wide circle, return into it. Sometimes these stray individuals would fly for a short distance with a peculiar rapid zigzag motion — a series of short sidewise jerks — and then return with the ordinary steady flight. In spite of these varied evolutions the mosquitoes showed a tendency to face in one direction, presumably towards the wind, although the evening was perfectly calm and there was no breeze apparent. As it began to darken the males began to leave the swarm one by one, flying upward, either into surrounding trees or more often they would disappear into the sky. On this evening copulation was not observed and from the following observations it may be assumed that union only takes place during the early part of the swarming.

Although stormy and cold weather intervened, the following Sunday proved fine and the ledge on the island was again visited. Shortly before 5 o'clock, with the sun still shining but near the horizon, a few males were found already assembled and engaged in their circling flight above the grass-tufts. Others came from different directions and joined the swarm and by sunset it consisted of perhaps sixty or seventy mosquitoes. It was difficult to follow the movements of single mosquitoes but it seemed that in circling about they described a figure-of-eight — sometimes on a plane, or ascending and descending. At 5.15 a pair was seen falling out of the middle of the swarm, grappling each other as they fell. They had not dropped far below the swarm when union was affected, and, swinging out in opposite directions, still united they drifted slowly away towards the ground. Within ten minutes six pairs were seen to drop out of the swarm and copulate in this manner but after that no more. Three of the pairs were captured in the net; one pair rested in the bottom of the net about a minute, then separated and flew out; the other two pairs remained united even after death in the killing-bottle. It could not be determined if in the slow flight of the united pair the female leads off as is the case with *pipiens*, but it is to be presumed so, as she is the larger. Neither could it be positively ascertained whether any females formed part of the swarm. None were seen to enter at the time copulation took place, but with the rapid and confused movements of the members of the swarm (some flying out of the swarm and back again, as described above) it was impossible to keep all the individuals under close observation. However it is safe to conclude that, as in *pipiens*, the swarm proper consists wholly of males — certainly the fifteen specimens captured out of the swarm on Oct. 7 were all males. If there is any choice made in the selection of a mate it must be on the part of the female, for there appears to be no effort made, or any struggle, on the part of the males to secure the female entering the swarm.

An interesting fact was the prompt reaction of the entire swarm to sound. The sound of the voice in conversation would, at the first shock, precipitate the entire swarm about a foot, and the mosquitoes would continue in rapid and confused movement while the speaking continued. This effect could be noticed even when one spoke in quite a low voice, and a pistol-shot, perhaps half a mile off, precipitated the swarm in the same manner. When silence was restored the swarm immediately resumed its normal flight. The experiment was repeated many times and each time the effect was instantaneous.

At about 5.30 the swarm began to diminish, the males flying off singly into the air. Very often a male would start off with a hesitating flight, and after flying some distance and hovering about as if reluctant to leave, would again return into the swarm. At last the swarm was reduced to three males which remained for some time, and at the last a single male remained, continuing his evolutions alone for fully three minutes, when, at 5.45, he too flew off.

A curious circumstance was the presence, on both occasions, of a swarm of minute Chironomidae in close proximity to the swarm of *Anopheles*. Mr. D. W. Coquillett kindly determined these as *Ablabesmyia pilosella* Loew. While these did not mingle with the swarm of *Anopheles* they were as close as they could be without interference. Apparently the spot which the *Anopheles* had fixed upon had the same attraction for them. This swarm seemed likewise to be composed wholly of males.

It seems remarkable that the attitude taken by *Anopheles* in copulation, end to end and facing in opposite directions, is identical with that of *Culex pipiens*. This remarkable agreement is significant when the structure of the tarsal claws is considered. In both forms it is pratically the same and all the claws of the female are simple. In both cases the legs are not made use of in the copulatory act itself but only in the preliminary scuffle. Dr. H. G. Dyar has found that *Culiseta consobrinus*, another form with simple claws and quite a distinct generic type, takes the same position in copulation. It is fair to assume that this is the mode of copulation in all the forms in which the female has simple claws. On the other hand it appears that in those forms in which the female has toothed claws the position in copulation is face to face, the pair clasping each other. The writer can confirm Goeldi's observation that *Stegomyia calopus* copulates in this manner. Dr. Dyar has observed the same method of copulation in *Aëdes varipalpus* Coq. One cannot avoid the inference that the difference in the structure of the claws is closely correlated with the mode of copulation. It would appear then that the structure of the claws is a purely adaptive one and therefore it cannot be considered of the deep classificatory significance attributed to it by Mr. Coquillett (Science, n. s., XXIII, p. 312, 1906). The correspondence of *Anopheles* and *Culex* (in the restricted sense) in claw structure does not indicate a closer relationship between these genera than with such forms as *Aëdes*. Nor does the marked difference in the claw structure of *Janthinosoma* and *Feltidia* disprove the close relationship of these forms indicated by their so closely similar larva and male genitalia. While the presence or absence of teeth on the claws may be used with advantage in the definition of minor groups, if used as a primary character it would result in quite arbitrary combinations. Indeed there is reason to doubt if it should be considered of even generic value.

Since the publication of my article on the swarming of *Culex pipiens* the following additional references to the copulation and swarming of Culicidae or Chironomidae have come to my notice.

1812. Floerke, H. G. (editor) Rauchende aber nicht brennende Thuerme. Repertorium des Neuesten u. Wissenswürdigsten aus d. gesammten Naturkunde, v. 4, p. 179–180.

1830. Anonymous. Insect Transformations. (London) p. 363–365.

1838. Lacordaire. Introduction á L' Entomologie, v. 2, p. 374–375, 492.

1851. "Acheta Domestica, M. E. S." Episodes of Insect Life, v. 1, p. 58–61.

1860. Hagenow, Fr. v., Nachlese über Mückenschwärme. Archiv d. Ver. d. Freunde d. Naturgesch. in Meklenburg, 14 Jahr, p. 457–458.

1865. Cowan, Frank. Curious facts in the history of insects, p. 278–280.

1871. Weyenbergh, H. Nog een paar waarnemingen van vliegenzwermen, benevens een overzicht van alle tot heden waargenomen vliegenzwermen. Tijdschrift voor Entomologie, v. 14, p. 221–231.

1891. Lynch Arribálzaga, Felix. Dipterologia Argentina. Revista del Museo de La Plata, v. 1, p. 364–365 (swarming of Culicidae); v. 2, p. 161 (note on the copulation of *Stegomyia calopus*).

1900. Grassi, Battista. Studi di uno zoologo sulla malaria. Reale Accademia dei Lincei (anno 246), p. 84.

1903. Gray, St. George. Theobald's Monogr. Culic., v. 3, p. 143 (copulation of *Stegomyia calopus*).

1905. Eysell, A. Sind die "Culiciden" eine Familie. Archiv Schiffs-u Tropen Hyg., v. 9, p. 51–52.

WRIGHT'S NOTES ON BUTTERFLY BIOLOGY.

BY VERNON L. KELLOGG, STANFORD UNIVERSITY, CALIFORNIA.

Mr. W. G. Wright's excellent handbook[1] of the butterflies of the West Coast of the United States is going to help all of us out here who are already interested in insects, and is going to inspire some others with this interest. The writer of the book is a veteran collector and observer, his years of entomological work in California already numbering twenty-five. His records of observation seem quite exact, and undoubtedly all that he has to say in this book, as far as it is based on personal observation, can be relied on. Therefore we may welcome with particular pleasure an interesting introduction -- the major part of the book being composed of an annotated catalogue of the butterfly species found in the Western States and of a complete series of excellent colored plates illustrating nearly all of these species — which introduction, called "General Features of Butterfly Life," is made up of some forty or more numbered sections, each with a special title, and all together including some merely curious, but many really valuable suggestive remarks, records of observations, odd conclusions, etc., about butterfly biology.

As many of these notes ought to find their way to all students of insect bionomics, whether they be especially interested in Western butterflies or not, I have extracted, for PSYCHE's readers, from these "general features" notes of Mr. Wright certain ones which seem to me particularly interesting or suggestive.

As the butterflies are, of all insects, those which we know best systematically and faunistically and also as regards their seasonal changes, their life history, in fact, their general biology, they are, like the North American birds, specially valuable for the student of species-forming, of the effects of isolation and environment, and, indeed, in general, of evolution.

I shall take up Mr. Wright's notes according to his own section numbers.

Section 2. Altitude is equivalent to latitude in its effect on ornamentation. A species which occupies both valleys and mountain heights will be found to be darker in color in those examples from the mountains than those living in the lower valleys. Example, *Meganostoma eurydice*, in valleys, becomes *M. e. bernardino* in its upper range.

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[1] *The Butterflies of the West Coast of the United States*, by W. G. Wright. Whitaker and Ray Co., San Francisco, 1905. Most of the sheets of this book were destroyed in the disaster of April 18 and following days, but a few copies in the hands of the author are for sale.

Section 5. *Range of butterflies.* An interesting brief discussion of the range limits of species and of what determines these limits. Food plant sometimes is the determining factor, sometimes obviously not; something not obvious in many cases, but real.

Section 12. *Seasonal forms.* In some cases the early spring appearers are darker in markings than the later ones; in other cases, as *Colias eurytheme,* the early or cold weather forms are paler than the later warm weather forms.

Section 13. *Hybrids.* Some interesting examples of butterfly hybridization are noted. Author has seen *Thecla dumetorum* and *Th. iroides* in copulo; also *Pieris rapae* plus *P. protodice.* Author noted both of these cases in seven years; in the same time he noted perhaps twenty other pairs of butterflies in regular mating; he concludes, therefore, that one pair of butterflies in every one hundred and forty is regularly mismated, that is seven out of one thousand. "Now if that per cent be normal and continues, we see at once that there can be no resulting fertile progeny from the mismating, for if there were intergraded varieties following every mismating the world would be full of hit-and-miss butterflies in a few years. It therefore appears conclusive that, as in other lines of the animal kingdom, the mismatings must be infertile immediately or in the next generation." [This is in opposition to Luther Burbank's belief that much of the variety in organisms, plants, at least, is due to fertile hybridizing. V. L. K.]

Section 14. *Dimorphism.* An interesting paragraph calling attention to white and black dichromatism of Argynnis and Colias. Author notes that the normal female of Colias is being replaced by the albino, and believes that the normal females of Argynnis nokomis, A. nitocris, and A. leto have all been supplanted by the black form. [This is in line with Emery's theory of the origin of secondary sexual forms — V. L. K.]

Section 16. An interesting paragraph on gynandromorphy. Author notes the capture of a specimen of Lycena piasus with male and female right and left wings (figured).

Section 17. *Sex-marks.* Notes an interesting secondary sexual character namely, in Nymphalidae the fore-legs or lappets of males "are fully clad with plenty of long hairs, while the lappets of the females are less fully clad in shorter and scanty hairs.

Section 20. *Non-feeding species.* Notes the non-feeding characteristic of the Satyridae; yet they have sucking proboscis.

Section 24. *Taming butterflies.* "Butterflies are easily tamed . . . .; a day or two will suffice to tame a butterfly so that when it sees you coming it will walk toward you, waving its wings in pleasure at your appearance, and gently unrolling its tongue as it walks along in anticipation of a sip of sweetened water; then it will climb upon you finger. . . . You must always approach the butterfly with gentle motions, with an absence of anything new or strange, or unexpected or unpleasant, when it is hungry and with food on your finger tips; and when you call it you must each time do so with the same motions and the same tone of voice. The females are more tractable and teachable than the males."

Section 25. *Length of a butterfly's life.* Notes on the duration of the imaginal stage in various butterfly groups; Graptas, Vanessas, Pyrameis (long-lived) Argynnis and Melitaea (a few weeks to two months), Satyridae (short-lived a week or so), and Chionobas iduna (ten days).

Section 27. *Rubbing the wings.* Author notes the curious habit of the Theclas and Lycaenas of rubbing the wings together while at rest. Author sees no explanation. [They are not improbably producing sound by rubbing special series of stiff upright scales together; I have referred to this phenomenon in an early paper on the scales of the Lepidoptera. V. L. K.]

Section 30. *Mimicry or simulation.* An interesting but rather peculiar section under this subject, including some excellent observations, but showing a curious lack of understanding, of the theory of protective resemblance and mimicry on the author's part. The author assumes that mimicry, where existent, is a *voluntarily* acquired condition of the mimicking or simulating species! Among the author's observations are the following: Most Satyridae alight "upon places concolorous with themselves." Chionobas gigas alights only on bare gray rock upon which gray moss and lichens grow. "When it alights on such a place you cannot distinguish it although you saw it alight only three yards away." . . . "During 25 years' butterfly work I have seen but one attempt of a bird to catch a butterfly; then it was a fly-catcher bird chasing a Colias, dashing after it many times until, tired out, it stopped and the Colias escaped."

Section 31. *Movement of butterflies.* By this title author means "the substitution of the abnormal female for the normal; the temporary or permanent disappearance of an entire species, and the unaccountable appearance of lost or unknown species; in fine, the change from one state of things to another state." Author notes the conditions of occurrence of pale females of Colias, the disappearance of the species Lycaena tequa in Southern California, the disappearance and reappearance of Lycaena xerxes near San Francisco, the becoming common of the former very rare Pampila melane, and the disappearance of Chionobas nevadensis, Satyrus wheeleri and Mechanitis californica.

Section 25. *Getting butterfly eggs for rearing.* Under this practical title author has some interesting biological notes on the egg-laying of butterflies. Parnassius, Argynnis, Euptoieta Neonympha, and all genera of Satyridae "will lay their eggs upon anything, even on the net itself if other matters, as proper shade, warmth, air and quiet, are agreeable." All other butterflies demand their own peculiar larval food plant, "and it is necessary that the plant should be fresh and bright, as the butterfly will not oviposit on a plant that is at all wilted."

Section 37. *Breeding in darkness and in cold.* "When caterpillars are bred or raised in darkness from egg to imago, the resulting imago will be darker in color than the normal; the dark spots or lines will be broader and more dense or dusky and the lighter ones will be sordid or dusky. But no excessive variation or deviation from the plan of the normal form has ever been noticed, for the effort has many and many times been made to create new forms by this method." So also by cold. Caterpillars raised in an ice house or in cold storage where the temperature is kept down as low as possible will never develop any radical variation, but the butterflies will be darker than they would have been if raised in a normal temperature.

Section 38. *Migration of butterflies.* Describes large swarms or flights of Pyrameis cardui, not always in the same direction, but generally to the northward. Some came from Baja California and reached British Columbia!

Large Butterfly Captured by Crab-spider.— On the 13th of August, 1905, a swallow tail butterfly (*Papilio troilus* L.) was found lying dead by the side of the Amboy Road at Tottenville, Staten Island. Clinging to the body of the butterfly under one of its wings, was a small whitish crab-spider 7 mm. long, such as is often found on flowers awaiting its insect prey. Evidently the large butterfly had been attacked by the small spider, and had flown away with it, only to die later by the side of the road. There were no flowers near and the butterfly must necessarily have flown some distance before being overcome.

The spider has been shown to Mr. J. H. Emerton, who says it is *Misumena aleatoria*; a species commonly found on the blossoms of wild carrot and thoroughwort where it sits between the flowers and catches butterflies and other insects that alight on them. He adds: — "A butterfly a little too large might easily carry a spider away as yours appears to have done."— Wm. T. Davis.

A NEW GENUS AND SPECIES OF THE FAMILY TACHINIDAE, PARASITIC ON *ARCHIPS CERASIVORANA*.

BY CHARLES W. JOHNSON, BOSTON, MASS.

Dichaetoneura n. gen.

This genus is closely related to *Phytomyptera* Róndani (Nouvi Annali delle Scienze Naturali di Bologna, 1845, p. 13, Tav. 1, figs. 1, 2). Róndani's figure shows the costal setæ only to the tip of the auxiliary vein, in this genus they are equally prominent to the tip of the first, and nearly as marked to the tip of the second longitudinal vein, one or two more conspicuous setæ are present before the junction of the auxiliary vein. *The first longitudinal vein is armed with a large bristle towards the outer end, while the third has two, on the noticeably thickened portion at the base.* In other respects it seems to resemble *Phytomyptera, i. e.*— in having the broad third antennal joint, and in the absence of the apical and posterior transverse veins. The marginal macrochaetae on the second and third abdominal segments are small, there are also discal macrochaetae on the third segment. The latter are sometimes present in *Phytomyptera* according to Braner and Bergenstamm, (Zweiflügler der Kaiserlichen museums zu Wien, Pt. III, pp. 148, 150, 1893.). Macrochaetae on the fourth segment large and numerous.

Dichaetoneura leucoptera n. sp.

♀ Head broad, face, front and occiput bluish-gray pollinose, frontal stripe reddish brown, forked above and narrowly extending along the ocellar triangle, upper angle of the cheeks also reddish brown, facial depression deep, and ridge prominent; vibrissae large with numerous smaller bristles above and on the cheeks, frontal bristles descend to nearly opposite the second antennal joint, there are two pair of orbital bristles, and the ocellar bristles are directed forward; first and second joints of the antennae, brown, very short, the second setose, the third black, broad and obtusely truncate, arista black, palpi brown.

Thorax including the pleurae and scutellum bluish gray pollinose, with two short, black, anterior, dorsal lines, and four postsutural and four sternopleural macrochaetae; scutellum bearing four pairs of marginal macrochaetae, two smaller bristles are also present on the disc of the scutellum. Abdomen broad, entirely black, somewhat shining and covered with fine setae. Legs black, with prominent rows of bristles. Wings broad with a whitish or milky tinge, costa and first longitudinal vein dark brown, the other veins yellowish. Squamae white. Length, 5 mm.

Five specimens of this species were obtained from Dr. F. W. Russell of Winchendon, Mass., who bred them from the pupa of *Archips cerasivorana* Fitch. Later I received a specimen from Mr. E. F. Hitchings of Waterville, Me., who bred it from the same moth, July 28, 1906. Mr. D. W. Coquillett informs me that the National Museum has also received a specimen from Mr. Hitchings. Type in the collection of the Boston Society of Natural History.

In connection with this I should also like to record the host of *Actia pilipennis* Fallen, which was bred from *Schizura concinna* S. & A., August 13, 1905, by Prof. John Barlow, of Kingston, R. I.

ENTOMOLOGICAL SOCIETY OF AMERICA.— The initial meeting was held in the American Museum of Natural History at New York City, Dec. 28, 1906. Prof. Wm. M. Wheeler delivered before the society an illustrated lecture on "The Polymorphism of Insects." Immediately after the lecture occurred the business meeting. Prof. J. H. Comstock of Ithaca, N. Y., was elected chairman and E. S. G. Titus of Washington, D. C., secretary of the meeting. The new society then adopted a constitution and by-laws and elected officers and the other members of the executive committee.

The following are the officers: President, J. H. Comstock, Ithaca, N. Y., 1st Vice President, James Fletcher, Ottawa, Can., 2nd Vice President, Henry Skinner, Philadelphia, Pa., Sec.-Treasurer, J. Chester Bradley, Berkeley, Cal.

The Executive Committee consists of the officers and the following Fellows: Wm. M. Wheeler, New York, N. Y., John B. Smith, New Brunswick, N. J., Herbert Osborn, Columbus, O., C. J. S. Bethune, Guelph, Can., F. M. Webster, Washington, D. C., and Chas. W. Johnson, Boston, Mass.

Following the business meeting there was a smoker at the Hotel Endicott given by the Brooklyn, Newark and New York Entomological Societies to the Association of Economic Entomologists and the Entomological Society of America.

The executive committee, at a meeting held December 29, decided to call a meeting of the society at Boston, Mass., in connection with the meeting of the International Zoological Congress in August, 1907. Full announcement will be made later. E. S. G. TITUS, *Secretary*.

VALIDITY OF THE CULICID SUBFAMILY DEINOCERITINAE.

BY EVELYN GROESBEECK MITCHELL, WASHINGTON, D. C.

In the August number of Psyche is a very interesting paper on *Deinocerites cancer*, by Mr. Fredrick Knab. He seems, however, to be possessed of certain delusions, which I shall attempt to relieve.

Before proceeding to this, I wish to say that I was partly in error regarding the labial plate of this larva. I described the plate from a single dissected specimen. Mr. Knab has since then shown me the labial plate of another specimen. In this,— and he says this is like others,— the two basal teeth and the central tooth are not, as I said (Psyche, Feb. 1906, p. 19, par. 4), longer than the rest, but are evenly graded; nor are the basal teeth spaced off any further than the rest. I believe that I described from a deformed specimen of the true labial plate and not, as Mr. Knab says, from an inner plate, but as the specimen is not now in my possession, I cannot absolutely verify this. I am aware that deformed labial plates are very rare; still I have seen a few. The teeth are otherwise as I described them, and I could tell the plate from any other at a glance, so characteristic is it.

I did not "bring forward as a discovery of Mr. Coquillett" the unusual length of the second antennal joint in the adult. I merely quoted his statement to me as to the *relative length* of this joint in *D. cancer* as compared with the length in all other known forms of Culicidae.

Nor did I assert that *only Deinocerites* possesses a groove in which the mandibles move. It is not the *presence* of this groove but its prominent *angulation* which is characteristic of this larva. Mr. Knab himself admits that this is unusual when he says that though "the same lateral expansion of this region occurs again in the larva of the Sabethid *Lesticocampa lunata*, the modification of the ridge into *rounded* lobes, outward from the maxillae — occurs in *most* mosquito larvae but may be *absent*, as in *Psorophora*." (The italics are mine.) I have not seen a specimen of *L. lunata* and Mr. Knab's figure of it, (The larvae of Culicidae classified as independent organisms, by H. G. Dyar and F. Knab - reprinted from the Jour. N. Y. Ent. Soc., Vol. XIV, No. 4, Pl. XV. Authors separates pub. Mar. 14, 1906 — the paper itself having been published in December), does not show any lateral expansion much resembling that of *Deinocerites*,— which, by the way, has a much more prominent and sharp angulation of the groove than shown in Mr. Knab's ventral view of the head, (Pl. V, Psyche, Aug. '06). But even if *L. lunata* had such a groove as

D. cancer, if only these two possess such an angulation surely this may be considered as one of the unusual if not unique characters of the latter larva.

As for the mandibles, I still believe these to be unique. I was careful, in view of possible discoveries, to say, (PSYCHE, Feb. '06, p. 19, last par.), in referring to the outer caudal angle of the mandible of other culicids than *Deinocerites* that "in other mandibles, *so far as the writer can ascertain*, this part forms an even, continuous curve with the rest of the mandible body." I had not then seen even the figure of *C. vector*. The straight, stiff, apparently spineless, (this is strange, as at least one or two rudimentary spines, though often hard to find, are present even on smoothly rounded mandibles), little projection on the outer angle of the mandible of *C. vector* is about as "similar" to the bent, thumblike, somewhat flexible, long-spined appendage on the *D. cancer* mandible as is the atrophied stump tail of a mandril to the prehensile caudal appendage of a South American monkey. Doubtless the projections are homologues. And, pray, on what are classifications based if not on modifications of homologous structures? Also, the outer angle of the mandible of *C. vector* is not, as in *D. cancer*, visible from above. The biting and other parts of the *C. vector* mandible are decidedly of the *Culex* type, as may be plainly seen by comparing them with my figure of a typical *Culex* mandible, (PSYCHE, Feb. '06, p. 11), and with the *Deinocerites* mandible illustrated on p. 17. (This figure, by the way, is, by a misprint, wrongly designated as "Maxilla of *C. salinarius*," which is on p. 20). For the description of a variation of the marginal comb, which agrees with *C. vector*, read par. 2, col. I, p. 13, of the same number.

I have, from the first, regarded *D. cancer* as a primitive type, and it is natural that later developed types should possess atrophied remnants of organs which were well developed in the more primitive forms (such for example, as the spines on the outer caudal angle of the mandible). I find this belief supported by Osten Sacken, who states that he considers the true Nemocera, to which the Culicidae belong, and most of which possess numerous well developed sensory hairs on the antennae, as being a higher development than the Nemocera anomala, which have relatively bare antennae, (Ent. Mon. Mag., XXVII, p. 35). He lays great stress on the characters of eyes and antennae for forming superfamilies among the Diptera. As in the true Nemocera the differentiation of eyes is reduced to a minimum, he gives to the antennal characters, especially the comparative length and abundance of the hairs on the male as compared with the female antennae, the greatest importance. If, then, so great an authority considers antennal characters of this nature as of such moment in differentiating *super*families, how much greater weight must be given to the value of the same characters in the making of *sub*families.

Now in *D. cancer* the antennae of both sexes are unusually long and bear relatively short and few hairs; moreover the antennae of the male have neither longer nor more numerous hairs than those of the female. In all other Culicidae the antennae are comparatively short and with more and relatively longer hairs than in *D. cancer*; and except in the Trichoprosopininae, (which have other distinctive subfamily characters), the male antennae are densely plumose, with much longer and much more numerous hairs than in the female. Therefore according to Osten Sacken's theory, *Deinocerites* is the most primitive.

By the above antennal characters the Culicidae may be divided into three sharply marked primary groups as follows:

Antennae of males with much longer and more numerous hairs than those of the females. Antennae of females with long hairs. Second antennal joint in both sexes less than 8 times as long as wide. Metanotum nude. Outer caudal angle of mandible of larva not thumblike, or flexed, never with long spines or visible from above. Mandibular groove not angulated. Ventral brush present.

Contains the subfamilies Anophelinae, Megarhininae, Psorophorinae, Culicinae, Uranotaeninae.

Antennae of males not more plumose than those of females.

Antennae relatively short, the hairs of the antennae of both sexes well developed, second antennal joint less than 8 times as long as wide. Metanotum bristly. Mandible of larva as in above section. Mandibular groove sometimes angulated, (in *L. lunata*, according to Knab). Ventral brush absent.

Subfamily Trichoprosoponinae.

Antennae long in both sexes, the second joint over 14 times as long as wide, the antennal hairs in both sexes short and sparse. Metanotum nude. Outer caudal angle of the larval mandible visible from above, thumblike, flexed, somewhat movable and with many long spines. Mandibular groove forming a distinct angle below base of antennae. Ventral brush present.

Subfamily Deinoceritinae.

Thus it would seem that the conclusions at which I arrived by a study of the larvae are borne out by the important antennal characters in the adults and that the subfamily Deinoceritinae is at least as well marked as any other.

PARATYLOTROPIDIA BEUTENMUELLERI SP. NOV.

BY ALBERT P. MORSE, WELLESLEY, MASS.

FACIAL costa shallowly sulcate, narrowed above at meeting with vertex. Vertex sub-acute in profile, plane above, its anterior margins angulate over shallow foveolae open below to the antennal fossae. Pronotum evenly tectiform above; the sides plane, meeting dorsum at an angle less pronounced posteriorly; lateral carinae straight, evenly divergent, obsolete near hind margin. Lateral lobes smooth above, longitudinally rugulose below on prozona, coarsely punctate on metazona, flavescent save for narrow fuscous border below lateral carinae. Prosternal spine pyramidal with rounded apex. Metepisternum with distinct ruga. Tegmina short, nearly as broad as long (4 × 5 mm.), truncate, apex broadly rounded, dorsal field broad, scarcely angulate with lateral. Hind femora of moderate size, olivaceous, rufo-flavescent above. Valves of ovipositor strongly exserted, slender, ventro-lateral teeth absent, dorso-lateral edges sinuous, without serrations. Cerci small, triangular, one-and-one-third times as long as wide, acutely pointed. Abdomen keeled above.

Ferruginous brown above, varied with flavescent on the abdomen; flavescent beneath and on sides of head, pronotum, and metepisterna. Hind femora olivaceous; hind tibiae deep red.

Length of body: 27.5; hind fem.: 13.6. Pronotum: prozona, 4, metazona, 3; width of metazona, 5. Tegmina: length, 5; width, 4 mm.

One female. Valley of Black Mt., N. C., Aug. 30, 1906. W. Beutenmüller.

This is a smaller species than *brunneri*, having the general appearance and coloration of several of the brachypterous species of Melanoplus inhabiting the same district. It lacks the conspicuous flavescent lateral stripes on the head, pronotum and tegmina characteristic of *brunneri*, from which it also differs markedly in the structure of those members. Discovery of the male is awaited with interest.

This species, though differing much from *brunneri*, is doubtless congeneric with it and is especially interesting as being the eastern representative of the genus. *Brunneri* occurs locally from Texas to Dakota, being apparently restricted to the undergrowth of open, rather dry, woodlands. It is probable that the present species will be found to have a similar habitat in the East. I take great pleasure in proposing for it the name of its discoverer, in honor of his researches upon the insect fauna of the southern Appalachians.

THE MEGACHILIDAE OF SOUTHERN MAINE.

BY J. H. LOVELL AND T. D. A. COCKERELL.

The value of the older collections of bees, which usually consist of specimens bearing only locality labels, is greatly impaired by the absence of flower-records; and they require to be supplemented by later and more carefully collected material. It is hardly worth while to-day to make a large collection of bees without placing on record for each specimen the name of the plant species upon which it was captured, the date of visit, and the locality. It is also desirable to observe whether the insect is sucking honey or gathering pollen. As bees are chiefly dependent upon nectar for food and upon pollen for brood-rearing they are of necessity constant and diligent visitors of flowers. Monotropic and oligotropic bees confine their visits to one or a few species of plants, while in the case of polytropic bees the species may fly only a part of the season, as with some species of *Andrena*. Even when the species fly during the entire summer there may be a portion of the time when only one sex is on the wing, as with the females of *Bombus* and *Halictus* in spring. It is evident that accurate flower-records will greatly facilitate both the labor of collection and determination.

Of the nineteen species of Megachilidae enumerated in this paper none so far as is known to the authors are oligotropic. The species of *Osmia* have been taken for the most part in May or June, while the species of *Megachile* and *Coelioxys* have all been collected later than July 9th. None of the species can be said to be common; and most, as an examination of the flower-records given below will show, are rare. *Osmia atriventris* and *O. melanotricha* are most frequently found on the flowers of Rubus strigosus, while *Megachile latimanus* is usually a visitor of the Compositae. These three species are the most common local forms belonging to this family.

Osmia.

Osmia atriventris Cr.

1864 *Osmia atriventris* Cr. ♀, Proc. Ent. Soc. Phil. 3: 29.

1903 *Osmia atriventris* Robt. ♀ ♂, Trans. Am. Ent. Soc. 29: 170.

The female has been collected on Rubus strigosus and Epilobium angustifolium and several other plants from June 16th to July 23rd. Three males were taken on Salix, May 6th and 7th, 1905. This species probably occurs throughout New England and the Eastern States; the type locality is Connecticut.

OSMIA MELANOTRICHA n. sp.

♀.— Length 9 to nearly 10 mm.; similar to *O. atriventris* but is usually larger, the Maine specimens of the latter species varying from 7 to 9 mm. When the face of *O. melanotricha* is viewed from above the middle third longitudinally appears to be clothed with much coarse black hair and the other thirds are white haired. This is rather suggestive of *O. albolateralis* Ckll., which, however, has some black hairs on thorax above, black hair on second abdominal segment, etc. Dorsal abdominal segments 3 to 5 are clothed with short black hair, these segments having also a very indistinct submarginal band of short pale hair. The abdominal hair is best seen in lateral view, and is an easily recognizable character. The ventral scopa is dense and black.

Seven females; six on Rubus strigosus, June 16–18; one on Epilobium angustifolium, July 16, 1905.

O. melanotricha occurs also in Colorado; at Ward, Boulder County, altitude about 9000 feet, on flowers of Phacelia (W. P. and T. D. A. Cockerell). The Colorado specimen differs a little from the Maine ones; the flagellum is decidedly reddish beneath, and the front and mesothorax are largely black.

OSMIA GLOBOSA Cr.

1864 *Osmia globosa* Cr. ♀, Proc. Ent. Soc. Phil. 3:36.

The female was taken on the flowers of Gaylussacia resinosa but bears no date (from my notes, however, I learn that I have collected on the flowers of the huckleberry on June 15th. J. H. L.). The specimen was compared with Cresson's type by Mr. H. L. Viereck; it is a little larger and has the pubescence paler.

The type locality is Great Slave Lake. Cresson does not mention any collector but it was probably obtained by Robert Kennicott (*cf.* Pop. Sci. Monthly, Jan. 1906, p. 70). The male which has not been described was collected on Salix, May 7th.

♂.— Length 7 mm. Black, resembles the female, face densely clothed with long white pubescence; antennae wholly dark, extending back as far as the tegulae; pubescence on thorax as in the female long and pale ochraceous. Abdomen subglobose, rather coarsely but shallowly punctured, except on apical margins; basal segment clothed with long white hair; sixth segment concave in lateral view, with thin but long white pubescence, its edge with a feeble hardly noticeable emargination; seventh deeply notched, the points obtuse; stipites large, yellowish, touching at tips, clothed above with very long dull white hair; spurs black.

Closely related to *O. frigida* Sm., separable in the female by the large amount of black hair on face; in the male by the total absence of a fringe of reddish hair on apical margin of fifth abdominal segment, and the black ventral surface of abdomen. The globose abdomen separates it at a glance from *O. óbjecta* Cr. *O. globosa* is easily known from all the Maine species by the entirely black color of the teguments.

OSMIA (LEUCOSMIA) ALBIVENTRIS Cr.

1864 *Osmia albiventris* Cr. ♀ ♂, Proc. Ent. Soc. Phil. 3: 31.

One female specimen taken on Rubus strigosus, June 16, 1905. The male was found on the flowers of the blackberry, June 15.

OSMIA INSPERGENS n. sp.

♀.— Length 8 mm., rather stout with globose abdomen. Bluish-green, the head wider than the distance between the wings, densely and finely punctured, clothed with white pubescence; lower part of the clypeus produced, black, covered with very dark brown pubescence; from beneath the edge project two tufts of short stiff red hairs; mandibles deeply punctured, black, tridentate; antennae nearly black. Mesothorax densely and finely punctured, more sparsely in the middle; clothed with long hoary pubescence except upon the dorsum, which is nearly bare; there are no black hairs on vertex or thorax. Wings subhyaline or tinged with dusky, a dark shade in the marginal cell, nervures dark, basal nervure before transverse medial, tegulae rufo-piceous. Legs normal, black, with light hair, fuscous on inner side of tarsi, and at apex of middle tibiae beneath. Abdomen subglobose, greenish-blue, with a bright steely lustre, minutely punctured, 1st segment clothed with white pubescence at base, apical segment with fine white tomentum; ventral scopa dense, silvery-white, black at apex.

One specimen, taken on Vaccinium macrocarpon probably in July. Easily known from *O. albiventris* by the larger size, and dark hair at apex of clypeus, and at apex of abdomen beneath. In the venation it resembles *O. canadensis*, but the clypeus is not at all as in that species.

OSMIA (CENTROSMIA) BUCEPHALA Cr.

1864 *Osmia bucephala* Cr. ♀, Proc. Ent. Soc. Phil. 3: 17.

1864 *Osmia latitarsus* Cr. ♂, Proc. Ent. Soc. Phil. 3: 20.

1895 *Osmia bucephala* Robt. Trans. Am. Ent. Soc. 22: 125.

One male taken May 11, 1905, on the inflorescence of Acer saccharinum. A remarkable species, easily known in the male by the very large hind spurs and peculiar middle tarsi.

HERIADES.

HERIADES CARINATUS Cr.

1864 *Heriades carinatus* Cr. ♀ ♂, Proc. Ent. Soc. Phil. 2: 383.

Three males; two taken July 28th, the third on the flowers of Kalmia angustifolia which blooms here in July.

ALCIDAMEA.

ALCIDAMEA SIMPLEX Cr.

1864 *Heriades simplex* Cr. ♀, Proc. Ent. Soc. Phil. 2: 384.

1864 *Alcidamea producta* Cr. ♂, Proc. Ent. Soc. Phil. 2: 386.

1903 *Alcidamea producta* Robt. ♀ ♂, Trans. Am. Ent. Soc. 29: 171.

One female on Epilobium angustifolium, July 30th; two females on cultivated blackberry, June 15th; two males collected on blackberry, June 24th and 25th.

MEGACHILE.

MEGACHILE MELANOPHAEA Sm.

1853 *Megachile melanophaea* Sm. ♀ ♂, Cat. Hym. Brit. Mus. 1: 191.

The female visits Epilobium angustifolium from July 19th to 30th, and has also been collected on Vicia Cracca and Apocymum androsaemifolium. The male has been taken on Rubus strigosus, June 16th, and Vicia Cracca about July 20th. It is related to the western *M. wootoni* Ckll., and to the European *M. circumcincta* Kirby. Friese puts *circumcincta* in *Megachile*, s. str.; Titus refers *melanophaea* to *Xanthosarus*, where it seems rather out of place.

MEGACHILE (XANTHOSARUS) LATIMANUS Say.

1823 *Megachile latimanus* Say, ♂, West. Quart. Rep. Cin. 2: 81.

1853 *Megachile acuta* Sm. ♀, Cat. Hym. Brit. Mus. 1: 192.

The male has not been taken in this locality. The female which is rather common, has been found from July 30th on Carduus odoratus to Sept. 7th on Solidago; also on Inula Nelenium and Aralia hispida.

MEGACHILE (XANTHOSARUS) VIDUA Sm.

1853 *Megachile vidua* Sm. ♀, Cat. Hym. Brit. Mus. 1: 192.

1853 *Megachile frigida* Sm. ♂, Cat. Hym. Brit. Mus. 1: 193.

The female was collected on Carduus odoratus, July 30th; also on Epilobium angustifolium.

MEGACHILE ALBULA n. sp.

♂.— Length 10–12 mm. Black, abdomen parallel-sided, head and thorax densely and finely punctured; face, clypeus, cheeks below, mesothorax, pleurae and sides of metathorax clothed with long white pubescence, some fuscous on vertex, and on each side of middle of mesothorax, separating the lateral white hair from the central bare space. Head broad, clypeus deeply emarginate, mandibles black, 4-dentate varying to 3-dentate, (the third tooth absent), with a large basal tooth below, middle of lower margin presenting a slight angle; cheeks beneath with a strong but obtuse tooth, hairy without, concave and shining within; antennae black, flagellum slender, obscure reddish beneath, last joint not discoid. Mesothorax densely punctured in front, more sparsely in the middle. Legs black, coxae with strong but only moderately large spines; anterior femora keeled beneath, posteriorly with much white hair, anteriorly except the broad upper margin, yellowish-ferruginous; their tibiae ferruginous beneath, black above; their tarsi flattened and somewhat dilated; the first joint narrowly concave beneath, the concavity light ferruginous and fringed on either margin with short black hair; second joint reddish, cordate; a dense fringe of long white hair behind, from the apical two-fifths of the tibia to the third joint of the tarsus; middle and hind legs ordinary; claws bidentate, without a basal tooth. Wings dusky hyaline, margins not clouded, tegulae brownish-black. Abdomen broad with numerous small shallow punctures; 1st segment clothed with long hoary pubescence; 2nd, 3rd and 4th segments with obscure white fasciae on the extreme sides in apical grooves, but in general effect the abdomen is black and bandless; 6th segment with carina strongly notched, apical margin with two median and two lateral teeth; and in addition a median prominence, all of these being short and relatively inconspicuous; ventral segments four.

Two males on Epilobium angustifolium, July 30th. A very distinct species, superficially like *M. melanophaea*.

MEGACHILE DECIPIENS n. sp.

♂.— Length a little over 12 mm.; width of abdomen about 4 mm.; black, moderately shining; hair of head and thorax long and white, dark fuscous on vertex, middle of mesothorax, and partly on scutellum; mandibles coarsely striato-punctate, the apical tooth large, the second small, the third rudimentary; antennae black, flagellum faintly reddish beneath, last joint not flattened; vertex broad, shining, with scattered punctures, Mesothorax with close and distinct but rather shallow punctures; tegulae black, wings dusky, quite dark; legs black, with white hair, yellowish on inner side of tarsi; anterior coxae with a strong dentiform angle but no spine; anterior tarsi slender and quite simple with a fringe of white hair behind; anterior femora entirely black; claws strongly bifid with no basal tooth. Abdomen rather short, the first two segments with white hair, the others with black hair; hind margins of second and following segments with dense pure white hair bands, on 2nd only at sides, on 3rd and 4th very weak in the middle; 6th segment vertical, with a prominent transverse keel, which is not at all dentate or crenulate, but is very broadly truncate, the truncation concave; beneath there is a median transverse gently rounded elevation, and a very small tooth on each side easily overlooked; ventral segments four.

Two males collected on Rhus typhina, July 10th; and Epilobium angustifolium, July 30th. This is a *Cyphopyga* closely related to *M. montivaga,* but differing in the structure of the apex of the abdomen, and to a considerable extent in the color of the pubescence. *M. decipiens* has been confused with *M.* (*Anthemois*) *infragilis* Cr., but that differs in the color (yellow) of the pubescence, the wings dusky only apically, the smaller size, the dentiform angles on the front coxae, and the structure of the apex of the abdomen.

MEGACHILE RELATIVA Cr.

1878 *Megachile relativa* Cr. ♀, Trans. Am. Ent. Soc. 7: 126.

Female taken on Epilobium angustifolium, July 23rd; Solidago, Aug. 21; Inula Helenium, Aug. 7th; male on Epilobium angustifolium, July 23rd; Solidago, August 21st.

MEGACHILE BREVIS Say.

1837 *Megachile brevis* Say, ♀ ♂, Bost. Jour. Nat. Hist. 1: 407.

Two females; Spiraea salicifolia, August 4th; Solidago, August 28th.

COELIOXYS.

COELIOXYS RUFITARSIS Sm.

1854 *Coelioxys rufitarsus* Sm. ♂, Cat. Hym. Brit. Mus. 2: 271.

1854 *Coelioxys dubitata* Sm. ♀, Cat. Hym. Brit. Mus. 2: 272.

1864 *Coelioxys rufitarsus* Cr. ♂, Proc. Ent. Soc. Phil. 2: 400.

1864 *Coelioxys dubitata* Cr. ♀, Proc. Ent. Soc. Phil. 2: 400.

1897 *Coelioxys rufitarsis* Robt., Trans. Ac. Sci. St. Louis, 7: 345.

Female taken on Carduus arvensis, Aug. 7th; Solidago, Aug. 19: male on Solidago, July 27th.

COELIOXYS SAYI Robt.

1824 *Coelioxys octodentata* Say, ♂, var. a, Long's 2nd Exp. 2: 353.

1837 *Coelioxys octodentata* Say, ♀, Bost. Jour. Nat. Hist. 1: 400.

1864 *Coelioxys octodentata* Cr. ♀ ♂, Proc. Ent. Soc. Phil. 2: 401.

1897 *Coelioxys sayi* Robt. ♀ ♂, Trans. Ac. Sci. St. Louis, 7: 346.

Male collected on Aralia hispida, July 19th; and Epilobium angustifolium, July 30th.

COELIOXYS OCTODENTATA Say.

1824 *Coelioxys octodentata* Say, ♂, (ex. var. a), Long's 2nd Exp. 2: 358.

1864 *Coelioxys brevis* Cr. (not Ev.), ♀ ♂, Proc. Ent. Soc. Phil. 2: 402.

1897 *Coelioxys octodentata* Robt., Trans. Ac. Sci. St. Louis, 7: 345.

One male taken Aug. 11th, on Solidago. These species as commonly recognized have a wide range, and it is not impossible that there are more distinct forms than the nomenclature indicates.

STELIS.

STELIS (MICROSTELIS) FOEDERALIS Sm.

1854 *Stelis foederalis* Sm. ♀ ♂, Cat. Hym. Brit. Mus. 2: 275.

1864 *Stelis foederalis* Cr. ♀ ♂, Proc. Ent. Soc. Phil. 2: 410.

Two females taken on Epilobium angustifolium, July 23rd. A rare species in this locality, also found at Montreal, Canada.

PROCEEDINGS OF THE CLUB.

THE 262d regular meeting of the Club was held on Tuesday evening, December 18, 1906, in the rooms of the Appalachian Mountain Club. Nine members present; President Field in the chair. . . .

The President exhibited a partially developed pupa of *Vanessa antiopa*. A fall having arrested pupation, the small chitinous portion of the pupa which extended from the larval skin, instead of being normal, had assumed the form of the larva's head. He also showed a large mole cricket (*Gryllotalpa* sp.) which injures the tennis grounds in Pernambuco, Brazil, and some small lepidopterous larvae, great numbers of which had infested a barn in Milton, Mass. Discussed by members.

Mr. Johnson showed a specimen of *Tibicen rimosa* obtained by Mr. Frost at Monmouth, Maine. Its distribution and superficial resemblance to *T. septendecim* were commented upon. A new genus, *Okanagana*, has recently been proposed by Distant for this species. He also exhibited specimens of a new Tachinid allied to the genus *Phytomyptera* of Europe. It was bred by Dr. Russell from *Archips cerasivorana*.

The next meeting being the annual meeting of the Club, it was voted that the President should appoint a Nominating Committee. Messrs. Johnson, Emerton and Bolster were appointed. A revised list of names and addresses of members was discussed and referred to Mr. Blackburn.

The meeting adjourned at 9.50.

CHAS. W. JOHNSON,
Secretary pro tem.

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PSYCHE

THE NORTH AMERICAN SPECIES OF GLARESIS.

BY H. C. FALL, PASADENA, CALIFORNIA.

Among a miscellaneous lot of coleoptera sent me for identification by Mr. Chas. Fuchs of San Francisco about a year ago, were two undescribed species of Glaresis. These latter were retained for study when the lot was sent back, and so escaped the destruction which befell the greater part of Mr. Fuch's collection in the terrible earthquake and fire which devastated San Francisco.

The comparative characters given by Dr. Horn in his descriptions of *G. inducta* and *mendica*[1] are not very pronounced, are subject to some variation, and in respect to the elytral costae are actually misleading, having been — as I later discovered — accidentally reversed. It was thought best therefore to postpone further action till a comparison could be made with the types. Such comparison having been made it now seems proper to present descriptions of the new forms, with some comparative notes.

Glaresis ecostata n. sp.

Moderately robust, very slightly wider posteriorly, rufotestaceous throughout. Mandibles rather deeply sinuate externally; head nearly smooth, not impressed, epistoma squarely truncate. Prothorax of the usual form, apical marginal groove wanting, median groove very faintly indicated, no discal impressions; the linear granular elevations of the surface sparse and indistinct. Elytra with rows of rather small very feebly defined shallow punctures, the intervals slightly convex but not at all costiform, each with the usual line of short suberect fulvous setae. Outer apical angle of middle tibiae only moderately prominent; outer margin of hind tibiae deeply emarginate before the apex. Length 4.5–4.7 mm., width 2.4 mm.

Two examples of this fine species are before me, one taken in June at Pilot Knob (near Yuma) California; the other collected by Dr. Fenyes May 20 at Palm Springs, Cal. It is our largest species, and is, aside from size, at once separable from all others by the deeply emarginate hind tibiae and nearly flat elytral interspaces. The hind tarsi decrease notably in width from base to apex the basal joint being almost twice as wide as the apical one. Slight individual differences in the hind tarsi have been noticed in other species and I suspect these to be sexual, there being a tendency in the less robust specimens — presumably males — toward more slender tarsi, with the joints of more uniform width.

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[1] Trans. Am. Ent. Soc. XII, 1885, p. 117.

Glaresis phoenicis n. sp.

Similar in form to *mendica* and *ecostata*; entirely rufotestaceous. Mandibles strongly obtusely toothed externally. Head very faintly and sparsely tuberculate, smooth behind. Epistoma broadly sinuate. Prothorax without apical groove or discal impressions, the median groove barely perceptible. Elytral costae feeble to moderate, strial punctures usually obscure, but better marked in some specimens. Outer apical angle of middle tibiae strongly produced; hind tibiae feebly sinuate before the apex. Length 3–4 mm.

Phoenix, Arizona. Several examples sent by Mr. Fuchs. Intermediate in size between *ecostata* and the smaller *mendica* and *inducta*. The elytral costae are distinct enough though less sharply defined than in the smaller species. *Phoenicis* differs from all others in the strongly produced outer apical angle of the middle tibiae, and in the strong lobe like tooth of the outer margin of the mandibles, which structure is, however, foreshadowed in *ecostata*.

G. mendica Horn.
G. inducta Horn.

These two species are mutually very closely related and the small differences of sculpture are easily obscured by the indument with which they are frequently coated. *Mendica* is the less robust of the two, the difference being quite obvious when series are compared; the apical marginal groove of the pronotum is well defined, the medial groove deeper, and there are two more or less evident discal impressions before the middle. In *inducta* the thoracic sculpture is generally less pronounced, the apical groove becoming obliterated at middle, the medial sulcus is fainter, and the discal impressions are lacking. The elytral costae are normally quite strong in both, but are rather better developed in *inducta* instead of in *mendica* as stated by Horn. Both species are smaller than *ecostata* or *phoenicis*, ranging in length from 2.8 to 3.6 mm., the latter measurement applying to an unusually robust specimen. In neither species is the outer margin of the mandibles more than very faintly sinuate, nor do either exhibit the tibial modifications possessed by the two new forms.

Mendica was described from Arizona, and has been taken at Palm Springs and Pasadena, California, by Dr. Fenyes and myself. A Lower California specimen sent by Mr. Fuchs and labeled *mendica* by Horn, is apparently a good subspecies, differing from the typical form by its slightly more robust form and more deeply perforate elytral punctures. I am unwilling to give it a name without first seeing other examples.

Inducta, described from Western Texas, has been collected by Rev. Birkmann at Fedor, in Central Texas, and five specimens are now before me. It is probable that this species may be safely identified by its locality label.

The more important characters of our four species are summarized in the following table.

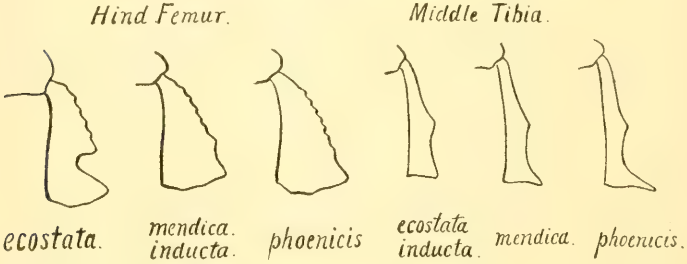
1. Outer margin of hind tibiae deeply emarginate before the apex; elytral interspaces merely slightly convex . . . . *ecostata.*
   Outer margin of hind tibiae not or but slightly emarginate; elytral interspaces more or less distinctly costiform . . . . 2.
2. Outer apical angle of middle tibiae strongly acutely produced; prothorax without apical marginal groove . . . . *phoenicis.*
   Outer apical angle of middle tibiae not strongly produced; post-apical impression of prothorax distinct, at least at sides . . . . 3.
3. Post-apical groove of prothorax deeper at sides, nearly obsolete at middle; anterior discal impressions wanting; form stouter . . . . . . *inducta.*
   Post-apical groove distinct from side to side, not much deeper laterally; anterior discal impressions distinct; form less robust . . . . . . *mendica.*

Certain differences in the armature of the posterior trochanters and femora should here be noticed though I have not thought best to introduce them in the preceding table, it being possible that with larger material they may prove to be in some degree variable or sexual in nature. They are however practically constant within specific limits in the material at hand, in which it is probable that — in some species at least — both sexes are present.

In all the species except *ecostata* there is a small spiniform tooth near the outer extremity of the postero-superior margin of the hind trochanters. This tooth is not visible directly from beneath, being concealed by the more prominent lower margin of the trochanter, but may be viewed obliquely from behind. In *ecostata* — as if to make up for this omission — the lower visible edge of the trochanter bears two small rather distant teeth, no trace of which exists in the other three species, the posterior edge of the trochanter being obtusely angulate however in *phoenicis.* In all the species except *phoenicis,* the postero-superior margin of the hind femora bears near the middle one or two very small acute or spiniform teeth, these as before being visible only from the rear; and here again by way of compensation *pheonicis* has the lower visible margin of the thigh with a more or less acute tooth close to the junction with the trochanter, there being no sign of this in either of the other species.

In the Hungarian *frivaldskyi*, as exemplified by a specimen sent by Mr. Fuchs, the thoracic sculpture is more pronounced than in any of our species, the postapical and median grooves being deeper and the disk with four well defined impressions; the mandibles are moderately sinuate externally, the outer apical angle of middle tibiae not much produced, the hind tibiae more deeply emarginate subapically than in any of our species except *ecostata*. The posterior trochanters have a minute tooth at the outer extremity of lower margin, the superior margin with a very small vestigial tooth, the hind thighs not perceptibly toothed. The elytral costae are well developed and the size is nearly that of our own *mendica* and *inducta*.

The following simple diagrammatic sketches exhibit with a fair degree of accuracy the tibial differences alluded to above.



HOSTS OF INSECT EGG-PARASITES IN NORTH AND SOUTH AMERICA.

BY A. ARSÈNE GIRAULT, WASHINGTON, D. C.

The following compilation of the hosts of the insect egg-parasites is made for several reasons, the most important of which is the labor which it saves by bringing together the much scattered rearing records of these insects. Other reasons are the importance of egg-parasites as a class, the aid given in identifying the parasites of any one host, and the interest which a compilation of this kind is likely to stimulate in the minds of economic entomologists for whom this list is primarily intended

The list considers the parasites from the standpoint of the host only, and it is not meant to bring out any important biologic facts concerning them, which should be considered rather in a list of the parasites and their hosts or host relations. Mainly, it answers but one question, "What parasites attack the egg of *Carpocapsa pomonella*, or other insect?" It is complete up to the end of the year 1906, and includes none but true, internal parasites of the egg, insects that pass their entire life-cycle within the egg of another insect excepting as adults. Insects that prey on the eggs, such as *Pimpla*, *Anthomyia*, *Sarcophaga*, *Eunotus*, often called egg-parasites, are not considered as such, and are therefore ignored; and parasites that oviposit on or into the egg, becoming fatal during some phase of postembryonic development of the host, through polyembryonic development, are also excluded, being considered parasites of the larva or pupa as the case may be. I consider *Platygaster herrickii* Packard a case in point.

The hosts are arranged alphabetically according to order, genus, and species, merely for the sake of convenience. A query preceding the parasite listed under any host, questions the record in one way or another; insects of doubtful generic position are enclosed within quotation marks New records are preceded by an asterisk. References to the literature are given in the most convenient way possible, and the nomenclature and synonymy are according to the latest authorities. Incomplete records are entirely omitted in the list, excepting in the case of a few important or suggestive ones. The record of the rearing of *Ablerus clisiocampae* Ashmead from the eggs of *Malacosoma americana* Fabricius has been proven to be undoubtedly incorrect, but in order to point out this mistake in as forcible a manner as possible, I have thought it wise to include it in the list of parasites of that host, there calling attention to the error. In this way, I doubly insure attention being drawn to the mistake. *Anopedius error* Fitch, erroneously recorded from the eggs of *Nabis* *ferus* Linnaeus, is treated in a like manner; it is a larval parasite of certain Diptera. And attention is also directed to the record of *Elasmus albicoxa* Howard from eggs of *Basilarchia archippus* Cramer, more or less discredited by both Howard and Ashmead (the latter, *in litt.*); and to the erroneous record of *Hadronotus leptocorisæ* Howard on *Leptocorisa tipuloides* DeGeer (Ashmead, 1887 b, p. 119; id., 1893 a, p. 231). *Polyneura* (Webster, 1903, p. 33) should be *Polynema*, so Mr. Webster informs me. The list requires no further explanation.

Our knowledge of egg-parasites does not compare favorably with that of the parasites of the larva. But for the writings of Howard, Ashmead, and Riley and Howard, the recorded rearings would be very meagre indeed. It is mainly through the efforts of the two former, that so much is now known of this most important class of insect parasites, and we are at the present day much more advanced in this respect than are our European neighbors.

Egg-parasites are not difficult to rear, and being, perhaps, the most potent enemies of many of our injurious insects, it is desirable that greater care and more thoroughness be taken in rearing work; so that on account of their minute size, they are not overlooked.

In connection with this list, I mention some of the insects which are known to be hosts of egg-parasites, the latter still unknown. In the Lepidoptera, *Anisota rubicunda* Fabr., *Euproctis chrysorrhoea* Linn. (Europe), *Junonia coenia* Hübner, *Malacosoma disstria* Hübner, *Megathymus yuccæ* Boisd. et Leconte, *Paonius excaecatus* Smith et Abbot, *Thorybes pylades* Scudder, and *Vanessa cardui* Linn. have been recorded as being attacked by egg-parasites. Among the Hemiptera is *Serinetha trivittata* Say; the hymenopterus genus *Hylatoma* is probably attacked by the eulophid *Hyperteles hylatomae* Ashm. (Ashmead, 1888, Canadian Ent., XX, p. 105); while certain Odonata (Howard, 1901, Insect Book, p. 366) are also recorded to be hosts of egg-parasites. A species of "*Trichogramma*" probably attacks *Hemerobius* (Howard, Hymenoptera, in Stand. Nat. Hist., Boston, p. 511).

The insect egg-parasites of the Americas are all hymenopterous, as far as we know definitely at the present time. The majority of them belong to the superfamilies Chalcidoidea (mostly the families Trichogrammidae and Mymaridae, and the following: — the family Torymidae < *Podagrion* only > ; Eurytomidae < Rileyini, — *Macrorileya* and *Neorileya* > ; and the Encyrtidae < Eupelminae,— *Eupelmus*, *Anastatus*; Encyrtinae,— *Oöencyrtus*, *Dinocarsis* > and Proctotrypoidea (mostly the Scelioninae, comprising *Phanurus*, *Telenomus*, *Trissolcus*, *Aradophagus*, *Prosacantha*, *Caloteleia*, *Baryconus*, *Macroteleia*, *Cacus*, *Hadronotus*, *Idris*, and *Scelio* in the tribes Telenomini, Teleasini, and Scelionini respectively, and the subfamily Ceraphroninae <*Aphanogmus* only>. Outside of these two superfamilies, certain of the Evaniidae (namely *Evania*) of the superfamily Ichneumonoidea are also egg-parasites of the true insects, the cockroaches.

The most prominent and common of the genera of egg-parasites are undoubtedly *Trichogramma* and *Telenomus*, and of the species, *Trichogramma pretiosa* Riley is foremost, attacking no less than eleven or more hosts. *Telenomus graptae* Howard follows as the second most common species, attacking six hosts.

Other genera and doubtless families in the Chalcidoidea and Proctotrypoidea will be found to be parasitic on the eggs of American insects when we become more advanced in our knowledge of them. In Hawaii, for example, such has been found to be the case (Perkins, 1905, p. 200 *et al*; 1906), and also in Europe in a few cases. The foregoing enumeration of parasitic families and genera, therefore, cannot be said to be restrictive.

The known hosts of egg-parasites in continental North and South America comprise the following orders as listed: Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Neuroptera, and Orthoptera, and in addition the Odonata. The families attacked in each order, where numerous, are widely separated, and in this respect the parasites seem to have very little choice. In order of being most attacked, in number of species, the Lepidoptera are first, then the Orthoptera, Hemiptera, Coleoptera and Hymenoptera.

Hosts and their parasites.

Coleoptera.

Host	Parasite.	Authority.
Attelabus bipustulatus Fabricius	*Poropoea* species	Hopkins, 1905, p. 132.
Chlaenius impunctifrons Say	*Prosacantha caraborum* Riley	Ashmead, 1893a, pp. 180, 191, 451.
Conotrachelus nenuphar Herbst	*Anaphes conotracheli* Girault	Girault, 1905, Ent. News, XVI, p. 220.
Fidia viticida Walsh	*Brachista fideae* Ashmead	Webster, 1896, p. 69.
	Fidiobia flavipes Ashmead	Slingerland, 1906, p. 93.
Odontota dorsalis Thunberg	*Trichogramma odontotae* Howard	Chittenden, 1902, p. 82.
Pityopthorus consimilis Leconte	? *Aradophagus fasciatus* Ashmead	Ashmead, 1893a, p. 166.
querciperda Schwarz	? *Aradophagus fasciatus* Ashmead	Dalla Torre, 1898, p. 512. *Cf.* Ashmead 1893a, p. 166.
Scarites subterraneous Fabricius	*Prosacantha caraborum* Riley	Riley & Howard, 1891, p. 124.
Tachypterus (*Anthonomus*) *quadrigibbus* Say	? *Gonatocerus anthonomi* Girault	Girault, 1905, Ent. News, XVI, p. 289.

Diptera.

Tabanus atratus Fabricius	*Phanurus tabanivorus* Ashmead	Ashmead, 1895, pp. 274-275.

Hemiptera.

Anasa tristis DeGeer	*Eupelmus reduvii* Howard	Ashmead, 1887a, p. 190.
	Hadronotus carinatifrons Ashmead	Girault, 1904, Ent. News, p. 336.
	Hadronotus rugosus Howard	Riley & Howard, 1891, p. 124.
	Hadronotus anasae Ashmead	Howard, 1888, p. 129.
	Oöencyrtus anasae Ashmead	Chittenden, 1899, p. 26.
Apiomerus spissipes Say	*Hadronotus* species novem.	Morgan, 1907, p. 54.
Arilus cristatus Linnaeus	* *Anastatus giraulti* Ashmead MS.	Girault, MS. notes, 1903.
	Eupelmus reduvii Howard	Howard, 1880, Can. Ent., XII, p. 208.
	* *Oöencyrtus johnsoni* Howard	Girault, MS. notes, 1905.
Brachyrhynchus granulatus Say	*Aradophagus fasciatus* Ashmead	Dalla Torre, 1898, p. 512. *Cf.* Ashmead, 1893a, p. 166.
Brochymena arborea Say	*Trissolcus brochymenae* Ashmead	Dalla Torre, 1898, p. 512.
species (on currant)	*Telenomus perplexus* Girault	Girault, 1906, Psyche, XIII, p. 66.
Ceresa bubalus Fabricius	*Trichogramma ceresara* Ashmead	Ashmead, 1888, Can. Ent. XX, p. 107.
	Polynema (*Cosmocoma*) species novem.	Riley, 1894, p. 215.
Coccus hesperidum (Linnaeus)	? *Trichogramma flava* Ashmead	Howard, 1888, p. 131.
Dysdercus suturellus Herrick-Sch.	? *Hadronotus rugosus* Howard	Riley & Howard, 1891, p. 124. Discredited by Ashmead, 1893a, pp. 232, 451.
Euschistus fissilis Uhler.	* *Trissolcus euschisti* Ashmead	Girault, MS. notes, 1905.
servus Say	*Trissolcus euschisti* Ashmead	Ashmead, 1893a, pp. 162, 451.
tristigmus Say	* *Trissolcus euschisti* Ashmead	Girault, MS. notes, 1905.
Euthoctha galeator Fabricius	? *Hadronotus rugosus* Howard	Ashmead, 1893a, pp. 232, 451.

Homalodisca triquetra Fabricius	*Ooctonus homalodiscae* Ashmead	Sanderson, 1906, p. 51.
Icerya purchasi Maskell	? *Phanurus opacus* Howard	Ashmead, 1893a, p. 142.
	? *Alaptus iceryae* Riley	Riley, 1888, Ins. Life, I, p. 130.
Largus succinctus Linnaeus	*Hadronotus largi* Ashmead	Dalla Torre, 1898, p. 498.
Lepidosaphes ulmi (Linnaeus)	? *Anaphes gracilis* Howard	Howard, 1888, p. 130.
Liburnia species	*Anagrus columbi* Perkins	Perkins, 1905, p. 198.
Metapodius femoratus Fabricius	*Hadronotus floridanus* Ashmead	Riley & Howard, 1891, p. 124.
Murgantia histrionica Hahn.	*Oöencyrtus johnsoni* Howard	Johnson, 1900, p. 21.
	Trissolcus murgantiae Ashmead	Morgan, 1897, pp. 140, 141, 159.
	podisi Ashmead	
Nabis ferus Linnaeus	? *Anopedius error* Fitch	Riley, 1880, pp. 196-197. *Cf.* Ashmead, 1893a, p. 291.
Pentatoma ligata Say	*Telenomus ashmeadi* Morrill.	Morrill, 1907, p. 10.
sayi Stål		
Podisus modestus Dallas	*Telenomus podisi* Ashmead	Ashmead, 1893a, p. 451. *Cf.* *ib.*, p. 159.
Podisus maculiventris Say	*Hadronotus* species nov.	E. Potts, 1891, Ent. News, II, pp. 53–54.
	? *Telenomus dimmocki* Ashmead	Dimmock, 1897, p. 148.
	Telenomus podisi Ashmead	Ashmead, 1893a, p. 159.
	Trissolcus podisi Ashmead	Riley & Howard, 1891, p. 124.
	? *Trissolcus thyantae* Ashmead	Dalla Torre, 1898, p. 512. *Cf.* Ashmead, 1893a, p. 163.
Thyantha custator Fabricius	*Trissolcus thyantae* Ashmead	Ashmead, 1893a, p. 163.
Tibicen septendecim Linnaeus	*Aphanogmus floridanus* Ashmead	Riley & Howard, 1891, p. 123. Queried by Ashmead, 1893a, p. 451.
	Lathromeris cicadae Howard	Howard, 1898, Can. Ent., XXX, pp. 102–103.
Zelus bilobus Say	*Hadronotus leptocorisae* Howard	Riley & Howard, 1891, p. 124. *Cf.* Ashmead, 1893a, p. 231, & 1887 b, p. 119.
longipes Linnaeus	*Hadronotus leptocorisae* Howard	Ashmead, 1887b, p. 119.

Hymenoptera.

Anthophorabia species	*Packardiella putnamii* Packard	Packard, 1880, p. 202.
Caliroa (*Selandria*) *obsoleta* Norton	*Trichogramma minuta* Riley	Morgan, 1897, pp. 144, 159.
Eriocampoides limacina Retzius (= *Selandria cerasi* Peck)	"*Encyrtus*" species	Marlatt, 1897, p. 6.
Isosoma captivum Howard	? *Oligosita americana* Ashmead	Webster, 1903, p. 35.
grande Riley	? *Oligosita americana* Ashmead	Webster, 1903, p. 22.
hordei Harris	*Oligositaamericana* Ashmead	Webster, 1903, p. 33.
	Polynema ((?) *Polyneura*) *citripes* Ashmead	
tritici Fitch	? *Oligosita americana* Ashmead	Webster, 1903, p. 22.
Pachynematus palliventris Cresson	? *Trichogramma pretiosa* Riley	Fletcher, 1893, p. 159. *Cf.* Riley & Howard, 1893, p. 289.
Pteronus ribesii Scopoli	*Trichogramma pretiosa* Riley	Howard, 1888, p. 124.

Lepidoptera.

Aglais milberti Godart	*Trichogramma intermedia* Howard	Scudder, 1889, I, p. 429.
Alabama argillacea Hübner	*Trichogramma pretiosa* Riley	Riley, 1879, Can. Ent., XI, pp. 161–162.
Alsophila pometaria Harris	"*Platygaster*" species	Riley, Packard & Thomas, 1883, p. 176.
	* *Telenomus gnophaelae* Ashmead	Girault, MS. notes, 1905.
Anosia plexippus Linnaeus	*Trichogramma intermedia* Howard	Howard, 1889, p. 1895.
Automeris io Fabricius	*Eupelmus* species	Howard, 1891, p. 568.
Autographa brassicae Riley	*Trichogramma pretiosa* Riley	Howard, 1888, p. 124.
Basilarchia archippus Cramer	*Trichogramma minuta* Riley	Fletcher, 1893, p. 160
	Trichogramma minutissima Packard	Scudder, 1889, I, p. 279.
	? *Elasmus albicoxa* Howard	Howard, 1885, p. 30. *Cf. id.*, Ins. Life, IV, p. 253.
Bellura gortynides Walker (= *densa* Walker)	*Telenomus arzamae* Riley	Ashmead, 1893a, pp. 158, 450.

Calpodes ethlius Cramer	"*Trichogramma*" species. A chalcid	Cockerell, 1892, Ent. News, III, p. 79.
Carpocapsa pomonella (Linnaeus)	*Trichogramma pretiosa* Riley	Slingerland, 1896, p. 70.
Chlorippe clyton Boisduval & Leconte	*Telenomus rileyi* Howard	Riley & Howard, 1891, p. 123.
Datana interregima Grote & Robinson	*Telenomus gossypiicola* Ashmead	Morgan, 1897, pp. 149, 159.
ministra Drury	*Eupelmus* species	Howard, 1891, p. 568. vide Dimmock, 1885, p. 279.
Diacrisia virginica Fabricius	*Telenomus spilosomatis* Ashmead	Riley & Howard, 1891, p. 123.
Euvanessa antiopa Linnaeus	*Telenomus graptae* Howard	Bruner, 1890, p. 103.
Gnophaela latipennis Boisduval	*Telenomus gnophaelae* Ashmead	Riley & Howard, 1891, p. 123.
Heliothis obsoleta Fabricius	*Telenomus heliothidis* Ashmead	Riley & Howard, 1891, p. 123, *cf.* Mally, 1893, p. 25.
	Trichogramma pretiosa Riley	Howard, 1888, p. 124.
	Trichogramma pretiosa nigra Girault	Girault, 1906.
Hemerocampa leucostigma Smith & Abbot	*Telenomus orgyiae* Fitch	Riley, 1887a, p. 32. *Cf.* Howard, 1897, pp. 7, 30-31, 52, & Hulst, 1889, p. 205. vide Packard, 1890, p. 265.
	Trichogramma fraterna Fitch[1]	Dalla Torre, 1898, p. 3.
	Trichogramma orgyiae Fitch[1]	
Heodes hypophleas Boisduval	*Telenomus graptae* Howard	Scudder, 1889, II, p. 1008.
Heterocampa bilineata Packard	*Telenomus graptae* Howard	Howard, 1894, p. 280.
Hyphantria cunea Drury	*Telenomus bifidus* Riley	Riley, 1887b, p. 531.
	Trichogramma species	Bruner, 1890, p. 43.
textor Harris	*Telenomus bifidus* Riley	Riley & Howard, 1891, p. 124.
Ianassa lignicolor Walker	*Trichogramma pretiosa* Riley	Dyar, 1893, p. 256.
Laphygma frugiperda Smith & Abbot	*Trichogramma pretiosa* Riley	Riley, 1885a, p. 104.
Malacosoma americana Fabricius	? *Ablerus clisiocampae* Ashmead[2]	Ashmead, 1893b, p. 10.

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[1] For the validity and synonymy of these two species, *cf.* Riley, 1887, p. 32, Packard, 1890, p. 265, and Howard, 1897, p. 7.

[2] Undoubtedly incorrect; a parasite of various species of Coccidæ, *cf.* Howard, 1894, p. 6, and others.

	"*Pteromalus*" species	Packard, 1880, p. 207, fig. 139.
	"*Platygaster*" species	Glover, 1877, p. 102.
	Telenomus clisiocampae Riley	Ashmead, 1893a, pp. 160, 450.
Malacosoma (*Clisiocampa*) species	*Telenomus clisiocampae* Riley	Ashmead, 1893a, p. 160.
Mamestra picta Harris	*Telenomus heliothidis* Ashmead	Davis, 1893, p. 26.
	Telenomus species novem	Fletcher, 1893, p. 161.
	Trichogramma pretiosa Riley	Fletcher, 1893, p. 161.
Melalopha inclusa Hübner	*Telenomus ichthyurae* Ashmead	Riley & Howard, 1891, p. 123.
Mompha (*Laverna*) *luciferella* Clemens	*Telenomus lavernae* Ashmead	Riley & Howard, 1891, p. 123.
Notolophus antiqua Linnaeus	*Telenomus orgyiae* Fitch	Howard, 1897, p. 30.
Notolophus (*Orgyia*) species	*Telenomus californicus* Ashmead	Ashmead, 1893a, pp. 150, 450.
	Telenomus orgyiae Fitch	Ibid., p. 153.
Oeneis macounii Edwards	*Trichogramma intermedia* Howard	Howard, 1889, p. 1895.
Paleacrita vernata Peck	"*Platygaster*" species	Riley, 1870b, p. 103.
Paonias myops Smith & Abbot	? *Eupelmus* species	Howard, 1891, p. 568.
Papilio glaucus Linnaeus	*Trichogramma minutissima* Packard	Scudder, 1889, II, p. 1304.
Papilio glaucus turnus Linneaus	*Trichogramma intermedia* Howard	Fletcher, 1893, p. 160.
	Trichogramma minutissima Packard	Fletcher, 1893, p. 160.
Phlegethontias sexta Johanssen	*Telenomus sphingis* Ashmead	Ashmead, 1893a, pp. 156, 450.
	Trichogramma pretiosa Riley	Ashmead, 1887c, p. 17.
Platynota rostrana Walker	*Trichogramma pretiosa* Riley	Hubbard, 1885, p. 153.
Polychrosis viteana Clemens[1]	* *Trichogramma pretiosa* Riley	Johnson, Fred, MS. notes, 1906.
Polygonia interragationis Fabricius	*Telenomus graptae* Howard	Riley & Howard, 1891, p. 123.
	Trichogramma intermedia Howard	Howard, 1889, III, p. 1895.
progne Cramer	*Telenomus graptae* Howard	Howard, 1889, III, p. 1891.

---

[1] North East, Penn.

Sanninoidea exitiosa (Say)	*Telenomus quaintancei* Girault	Girault, 1906, Psyche, XIII, p. 61.
Schizura leptinoides Grote	*Telenomus caelodasidis* Ashmead	Ashmead, 1893a, p. 159.
Sphida (*Arzama*) *obliqua* Walker	*Telenomus arzamae* Riley	Riley & Howard, 1891, p. 123
Telea polyphemus Cramer	*Telenomus sphingis* Ashmead	Dimmock, 1897, p. 148.
	Eupelmus species	Howard, 1891, p. 568.
Thanaos lucilius Lintner	*Trichogramma intermedia* Howard	Scudder, 1889, II, p. 1467.
Therina fervidaria Hübner, *somniaria* Hulst	*Telenomus* species novem	Fletcher, 1893, p. 160.
Thymelicus cernes Boisduval & Leconte	*Telenomus graptae* Howard	Scudder, 1889, II, p. 1731.
Thyridopteryx ephemeraeformis Haworth	*Dinocarsis thyridopterygis* Ashmead	Ashmead, 1886, p. 98.
Vanessa atalanta Linnaeus	*Trichogramma minutissima* Packard	Howard, 1889, p. 1895.

Neuroptera.

Chrysopa perla (Linnaeus)	*Telenomus* species	Howard, 1888, p. 123.
species	*Telenomus chrysopae* Ashmead	Ashmead, 1893a, pp. 159, 451

Orthoptera.

Amblycorypha oblongifolia DeGeer	*Anastatus mirabilis* Walsh.	Riley, 1870a, pp. 296-297, 369-370.
Blatta orientalis Linnaeus	*Evania appendigaster* (Linnaeus)	Marlatt, 1902, p. 11.
	Evania species novem	Cockerell, 1894, p. 209.
Blattella germanica (Linnaeus)	*Evania appendigaster* (Linnaeus)	Marlatt, 1902, p. 11.
Chortophaga viridifasciata DeGeer	? *Scelio oedipodae* Ashmead	Morgan, 1901, p. 24.
	? *Scelio hyalinipennis* Ashmead	Morgan, 1901, p. 24.
Dichromorpha viridis Scudder	*Scelio* species	Warner, 1903, pp. 308–309.
Dictyopterus reticulatus Thunberg	? *Scelio fuscipennis* Ashmead	Ashmead, 1893a, p. 243. *cf.* Dalla Torre, 1898, p. 495.
Dissosteira carolina Linnaeus	*Scelio ovivorus* Riley	Riley & Howard, 1891, p. 124.
Ischnoptera pennsylvanica DeGeer	*Evania dorsalis* (Westwood)	Ashmead, 1900, p. 7.

Mantis brasiliana Linnaeus	*Podagrion melleum* Westwood	Dalla Torre, 1898, p. 369.
Melanoplus atlantis Riley	*Scelio calopteni* Riley	Ashmead, 1893a, pp. 246, 451.
differentialis Thomas	*Scelio hyalinipennis* Ashmead	Morgan, 1901, p. 23.
	Scelio oedipodae Ashmead	Morgan, 1901, p. 23.
species	*Scelio luggeri* Riley	Riley & Howard, 1891, p. 124.
spretus Thomas	? *Scelio ovivorus* Riley	Riley, Packard & Thomas, 1878, pp. 305–306. *Cf.* Psyche, IV, 1883, p. 78.
Microcentrum retinerve Burmeister	*Anastatus mirabilis* Walsh	Hubbard, 1885, pp. 134–135.
Oecanthus fasciatus Fitch	*Anastatus mirabilis* Walsh	Ashmead, 1894, p. 245.
latipennis Riley	*Cacus oecanthi* Riley	Riley & Howard, 1891, p. 121.
	Caloteleia species	Bruner, 1890, p. 126, footnote.
	"*Rileya*" species	Bruner, 1890, p. 126, footnote.
nigricornis Walker,	*Anastatus mirabilis* Walsh,	Felt, 1906, p 699.
niveus DeGeer	*Baryconus oecanthi* Riley	Dalla Torre, 1898, p. 501.
	Cacus oecanthi Riley	Dalla Torre, 1898, p. 500.
	Caloteleia species	Bruner, 1890, p. 126, footnote.
	Idris species	Webster, 1891, pp. 345–346.
	"*Rileya*" species	Bruner, 1890, p. 126, footnote.
species	*Macrorileya oecanthi* Ashmead	Ashmead, 1904, p. 264.
"*Oedipoda*" species	*Scelio oedipodae* Ashmead	Dalla Torre, 1898, p. 495.
Orchelimum agile DeGeer	*Eupelmus xiphidii* Ashmead	Morgan, 1901, p. 31.
	Macroteleia sp., near *floridana* Ashmead	Morgan, 1901, p. 31.
glaberrimum Burmeister	*Macroteleia floridana* Ashmead	Ashmead, 1893a, p. 451. *Cf.* pp. 217–218.
	Macroteleia virginiensis Ashmead	Ashmead, 1893a, p. 218.
Periplaneta americana Linnaeus	"*Eulophus*" species	Westwood, 1839, p. 423.
	Evania appendigaster (Linneaus)	Ashmead, 1900, p. 7.
	"*Pteromalus*" species	Westwood, 1839, p. 423.
australasiae Fabricius	*Evania appendigaster* (Linnaeus)	Ashmead, 1900, p. 7.
Schistocerca americana Drury	? *Scelio hyalinipennis* Ashmead	Morgan, 1901, p. 24.
	? *Scelio oedipodae* Ashmead	Morgan, 1901, p. 24.
melanocera Stål	*Scelio ernstii* Riley	Riley & Howard, 1891, p. 124.
obscura Fabricius	*Scelio hyalinipennis* Ashmead	Morgan, 1901, p. 28.

	Scelio oedipodae Ashmead	Morgan, 1901, p. 28.
peregrina Olivier	*Scelio ernstii* Riley	Riley, 1885b, p. 22.
Stagmomantis carolina Linnaeus	*Podagrion mantis* Ashmead	Morgan, 1897, p. 159.
limbata Saussure	? * *Podagrion mantis* Ashmead	H. S. Barber, 1906, *In litt.*

Acknowledgments.

The compilation and arrangement of this list were first suggested by Dr. F. H. Chittenden, Bureau of Entomology, U. S. Department of Agriculture. I desire to thank Messrs. Otto Heidemann and A. N. Caudell, United States National Museum, for their kindness in correcting the nomenclature of the Hemiptera and Orthoptera respectively, and Dr. Wm. H. Ashmead of the Museum, and Mr. F. M. Webster of the Bureau of Entomology, for valuable information on various points. I would also like to acknowledge the courtesy of Mr. E. A. Schwarz of the National Museum, for untangling questions of nomenclature and synonymy in the Coleoptera.

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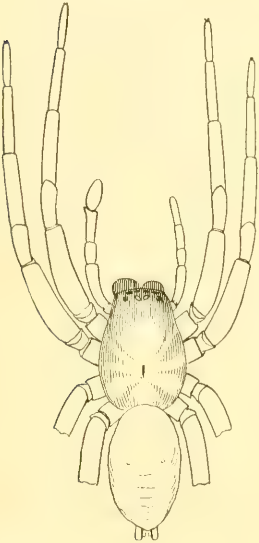
A FEMALE SPIDER WITH ONE MALE PALPUS.

BY J. H. EMERTON, BOSTON, MASS.



This is a large specimen of *Drassus saccatus* Em. collected with other spiders by Miss E. B. Bryant at Long Island, Portland, Me., Aug. 10, 1906, without its peculiarities being noticed at the time it was taken. The general appearance is that of an old female of large size with the abdomen small and shrivelled as in a female that has laid eggs. The epigynum is complete and symmetrical as in a normal female. The cephalothorax and abdomen are symmetrical and the third and fourth legs are alike on both sides. The right palpus is that of a female and the left that of a male with the palpal organ fully developed. The first and second legs of the left side are slightly longer than those of the right side. The left mandible is thicker than the right and the claw is slightly longer but the mandible is not elongated nor narrowed at the tip as it is in the male. Asymmetry of any kind is rare in spiders. Prof. W. M. Wheeler has called my attention to a case described by Kulczynski in one of the publications of the Cracow Academy of Sciences in 1885. This was an *Erigone fusca* Blk. which had the right side like the female and the left like the male. The epigynum was developed only on the right side and the asymmetry extended to the form of the cephalothorax and abdomen and even the spinnerets. The legs however were symmetrical in length, the only difference being in those of the first pair which had the right tarsus like the female and the left like the male.

THE SNOW-FLY, *CHIONEA VALGA* HARRIS.

BY CHARLES W. JOHNSON, BOSTON, MASS.

This species was evidently discovered by T. W. Harris prior to 1833, for in his list of the Insects of Massachusetts, in Hitchcock's Report on the Geology, etc., of Massachusetts, 1833, page 593, he refers to it as "Chionea —one species." In the second edition of Hitchcock's Geology, etc., 1835, page 575, the specific name *valga* is given. Harris's first edition of his Report on the Insects of Massachusetts injurious to vegetation appeared in 1841, in which, on page 404, he refers to this insect as follows: — "There are exceptions to almost all general rules. Thus we find, among Dipterous insects, some kinds that never have wings. One of these is the thick-legged snow-gnat, or *Chionea valga*. This singular insect looks more like a spider than a gnat. Its body is rather less than one fourth of an inch long, and is of a brownish yellow or nankin color. The legs are rather paler, and are covered with short hairs. The head is small and hairy. The first two joints of the antennae are thick, the others slender and tapering and beset with hairs. Although the wings are wanting, there is a pale yellow poiser on each side of the hinder part of the thorax. The hindmost thighs are very thick, and somewhat bowed in the males, which suggested the name of *valga*, or bow-legged, given to the insect in my catalogue. The body of the female ends with a sword-shaped borer, resembling that of a grasshopper. These wingless gnats live on the ground, and the females bore into it to lay their eggs. They are not common here."

The above was reprinted in the second edition, 1852, page 482, and in the third or Flint edition in 1862, page 601; in the latter a poor figure is given. This constitutes the only description given by Harris, but it seems sufficient to identify the species, and his type (the female) is still in good preservation; of the male only the genitalia remain.

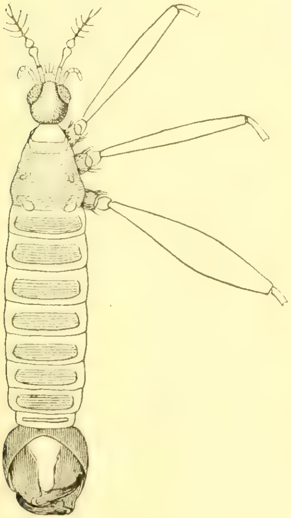
Mr. P. H. Gosse in his book entitled "The Canadian Naturalist," published in 1840, refers to them as "being doubtless the *Chionea araneoides*." He found them crawling on the snow, in pine woods, during the month of March.

In the brief and inadequate descriptions given by Walker of his two species, *C. aspersa* and *scita* (List I, p. 82, 1848), there seem to be no characters to separate them from *valga*.

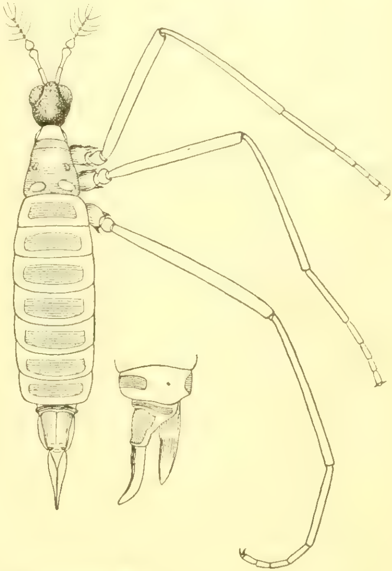
The description of *C. nivicola* Doane (Journ. N. Y. Ent. Soc., VIII, p. 189, 1900), based only on the female, agrees very closely with the female of *C. valga*, except that the antenna has eight joints. Schiner (Fauna Austr., II, p. 573, 1864), describes the European species as having six-jointed antennae. Osten Sacken (Mon. IV, p. 168) in referring to this, says:—"It seems to me that I can count four joints in the only specimen in my possession." The "four joints" refers only to the flagellum, making seven joints in all. The six specimens before me (including the type) all have seven joints. It seems singular that there should be this discrepancy in the antennæ, a generic character. The description of *C. nivicola* also calls for six abdominal segments (an unusual number for a Tipulid). A comparative study of the American and European forms seems very desirable.

Owing no doubt to its peculiar habits, it is rarely observed, and there are comparatively few records since its discovery by Harris more than eighty years ago. It has been found in Minnesota, and described and figured by the late Otto Lugger in his second annual Report, page 230, plate XVI, 1896. Later Mr. F. L. Washburn in the Tenth Annual Report, page 30, 1905, gives another figure of the species. It represents a male; the abdomen seems to be entirely too broad, and the genitalia are poorly shown. In the Canadian Entomologist for August, 1906, p. 275, Mr. C. N. Ainslie also records it from Minnesota.

Through the kindness of Mr. J. H. Emerton I am able to again record this species from New England. During a trip to the White Mountains Mr. Emerton was fortunate in finding this interesting species, and in regard to its capture says:—"Three males and one female of this rare insect were found walking slowly about on the snow, in sheltered places on the edge of the woods at Jackson, N. H., February 20, 1907. This was the last of several warm days when the snow had been melting in the sun at noon. The snow was two to three feet deep but there were open spots around larger trees and stones through which insects might come from the ground. The published figures of New England specimens are small and indefinite. I therefore give new drawings of both sexes." These specimens have been presented to the Boston Society of Natural History. There are also in the collection of the Society the type, and a specimen presented by Mr. Samuel Henshaw, which was taken by Mr. H. L. Moody at Malden, Mass. There is little to add to the descriptive remarks by Harris, and the description by Osten Sacken. The excellent figures by Mr. Emerton show clearly the genitalia and antennae, and also two minute protuberances which would indicate the normal position of the wings; these are quite distinct in the fresh specimens, which are preserved in alcohol, but in dried specimens seem to be obliterated. The three males collected by Mr. Emerton show considerable variation; the one figured measures about 6 mm., the other only about 4 mm. In one specimen the hind femora are scarcely thickened. The larva of *C. araneoides* of Europe lives in the ground, apparently upon vegetable matter. It has been described and figured in detail by Brauer (Verh. Zool. Bot. Ver. in Wein, IV, p. 609, 1854). Our species probably has similar habits. A larva found by Mr. Emerton in sifting for spiders, he thought might possibly belong to this species, but the structure of the head and posterior segment is very different from the larva figured by Brauer.



Chionea valga, ♂.



Chionea valga, ♀.

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BIOLOGICAL NOTES ON THE COLORADO POTATO BEETLE, *LEPTINOTARSA DECEMLINEATA* (SAY), WITH TECHNICAL DESCRIPTION OF ITS STAGES.

BY A. A. GIRAULT AND A. H. ROSENFELD.

During the spring and summer of 1906 it became convenient to make a brief study of this insect, more in reference to the biological aspects of its life than otherwise. There seem to be but few records in our literature concerning the duration of its different stages, especially in the southern United States. The following facts are therefore presented for publication without further comment. The observations were made at Myrtle, Ga., about 32 degrees, 30 minutes north latitude.

The Egg.

Description.— Length, 1.70- 1.80 mm.; 1.75 mm., average. Width, 0.80 mm., average, greatest diameter. Body uniformly bright orange, opaque, the ends paler, yellowish, and translucent. Shape elongate oval, the outline slightly irregular, and the caudal end or base, and the apex, regularly rounded. Surface simple, glabrous, apparently very minutely punctulate, with a moist appearance. Micropyle simple, inconspicuous. Chorion soft, easily crushed, and more or less elastic. To the naked eye, conspicuous.

Deposited erect, in small irregular masses of 20 or 30, more or less, generally on the under surfaces of the leaves. Caudal end held by a small orange pad of adhesive matter. (From many specimens.)

External Development.— The egg shows no sign of embryonic development externally until about the twelfth hour before hatching, when the perfect embryo is visible, together with all of the markings of the first larval instar at eclosion. The ocellar spots are in a rectangle at the anterior end of the egg, and the larger lateral tubercle areae and spiracles are distinctly visible on the sides. The setae are visible as blackish streaks along the sides in nearly regular rows. The disposition of the appendages is not distinct. The markings are more distinct as the egg approaches the time of hatching.

Duration of Stage.— In all the period of incubation for five hundred eggs has been determined to the hour, as accurately as possible under laboratory conditions.

Table I. Length of Period of Incubation at Different Dates, Myrtle, Ga. 1906.

Lot. no.	No. eggs.	Deposited. Time	Hatched. Time	Length of Stage Days	Length of Stage Hours.	Effective Temp' Degrees F.
1.	40.	May 21, 3:30 A.	May 26, 12:30 P.	5	9.	33.°
2.	53.	22, 5:00 A.	27, 5:00 P.	5	12.	32.67.
3.	30.	22, 1:30 P.	28, 3:30 A.	5	14.	33.50.
4.	41.	23, 8:45 P.	29, 11:00 A.	5	14¼.	33.21.
5.	9.	24, 1:45 A.	29, 11:00 A.	5	9¼.	33.75.
6.	40.	24, 9:00 P.	30, 7:30 A.	5	10½.	33.61.
7.	33.	25, 1:00 P.	30, 10:45 P.	5	9¾.	33.46.
8.	38.	26, 2:45 P.	31, 8:00 P.	5	5¼.	33.79.
9.	41.	27, 12:00 M.	June 1, 3:30 P.	5	3½.	34.53.
10.	23.	28, 12:30 P.	2, 1:45 P.	5	1¼.	35.95.
11.	39.	29, 3:25 P.	2, 10:10 P.	4	6½.	35.44.
12.	23.	30, 11:45 A.	3, 8:45 P.	4	9.	37.64.
13.	35.	31, 1:00 P.	4, 3:00 P.	4	2.	38.89.
14.	20.	June 2, 3:00 P.	6, 8:45 P.	4	5¾.	40.10.
15.	14.	3, 4:45 A.	7, 8:00 A.	4	3¼.	40.
16.	21.	3, 5:00 P.	8, 8:00 A.	4	15.	40.50.
Averages				4	23	35.62.°

Glancing down the column, it is seen that even during the short period of two weeks, there is a gradual decrease of the period of incubation, and a correspondingly gradual increase of the sums of effective temperatures. The exceptions are due to short cool spells.

The average of 35.62 degrees F. agrees well with most of the average sums of effective temperatures shown in the table.

Period of Hatching. The period of hatching of an egg-mass varies somewhat, but averages about three hours under usual spring conditions. The eggs in any single mass hatch almost simultaneously.

Number Deposited.

The data obtained on this point consists of but a single record, obtained by confining a pair of adults with food. These were captured *in copula* at 5 P. M. May 20, 1906, and then confined. The female deposited eggs as follows:—

Table II. Number of eggs deposited by a single female in confinement.

Date.	Mass Number.	No. Eggs.
May 21.	1.	40.
22.	2.	53.
22.	3.	30.
23.	4.	16.
23.	5.	41.
24.	6.	9.
24.	7.	40.
25.	8.	33.
26.	9.	38.
27.	10.	41.
28.	11.	23.
29.	12.	39.
30.	13.	23.
31.	14.	35.
June 2.	15.	20.
3.	16.	14.
3.	17.	21.
5.	18.	9.
		525

Period of Oviposition. From the table just given, it is seen that, in this case, the period of oviposition lasted for over fifteen days. However, this female was probably some days old when captured, so that the record is not complete, and a much longer period than this may be expected.

THE LARVA.

Description of the Instars. The larva or grub of the Colorado Potato Beetle is of the usual cruciform type, with a large, fleshy, subovate, prehensile body, antenniferous and hexapod, and bearing a terminal proleg. It is an external and voracious feeder, and grows rapidly, but is sluggish in habit.

Immediately following exclusion from the egg, the larva is entirely light orange (unicolored), with the following exceptions,— ocellar spots reddish, tubercle areas blackish, minute, inconspicuous, excepting three large areas, one on the dorsolateral aspect of the last two thoracic and the first abdominal segments; tibiae and tarsi paler, translucent; apical end of the antennae and the tips of the tarsi dusky; cervical and anal shields concolorous. Dorsal aspect, body uniformly orange yellow, paler at anal end, the three large tubercle areas above mentioned conspicuous, followed by the minute and much less conspicuous spiracles. Mandibles reddish brown; anal proleg large, paler. After several hours the larva becomes normally colored for the first instar.

Instar I.	Length after exclusion —	1.50 mm., avg.
	Length before ecdysis —	2.60 mm., avg.
	Width of head —	0.65 mm., avg.

Body fleshy, from cephalic aspect tubular, from dorsal aspect gourd-shaped; dorsal plane at head and thorax, inclined, at abdomen greatly convexed; lateral aspect, ventral plane straight, or slightly concaved near caudal end; with nine abdominal segments, the anal segment bearing a pair of prehensile prolegs. Body thickest at 4th abdominal segment, narrowed at head and thorax, and tapering caudad. Stigmata distinct, circular, and similar on thorax and abdomen; black.

Head peltate, narrower than following segment, flat, directed ventrad, glabrous black, subhirsute, rather soft, though chitinous. Ocelli six, 4 arranged so as to form a square, the remaining two in a line on the lateral aspect of the head; the lateral two ocelli, of the four in a square, are ocellate with orange; all slightly protuberant, and black. Antennae 3-jointed, the first joint paler, joints 1 and 2 subequal, broader than joint 3; the apical joint conical, ending in three or four stiff, sensory setae, and paler distally (dorsal aspect); in reality (lateral aspect) black, nearly uniform in width, the distal joint apparently 2-branched, its dorsal branch much the larger, cylindrical and truncate, and the ventral branch slender, conical, and spine-like, in reality, a spinous prolongation of the ventro-cephalic angle of joint 3 (the appendix).

Mandibles short and broad, at base about two-thirds as wide as long, pale yellowish, fuscous at tips, subrectangular, outer margin slightly curved and convex, the inner margin shorter and irregular; with four strong acute serrations, of which the first three are about equal in size, the second, however, about one-third longer, the fourth or inner one-half shorter and blunt. Maxillary palpi 3-jointed, longer than the antennae; labial palpi 2-jointed; both apparently with an additional basal joint, evidently a portion of the stipes; both paler at tip. Labrum broad, notched at the median line. Maxillary and labial palpi both bear sensory setae.

Thorax cylindrical, prothorax largest, its shield covering nearly the whole of the dorsum, black and divided by a thin median line concolorous with body; tubercles more abundant on the shield. Thoracic segments corrugated, the sclerites inconspicuous.

Legs black, the articulations paler, 5-jointed (usual leg joints), the coxa broad, tibia and femur subequal in length, the former more slender; from dorsal aspect (natural position), most of the tibia and all of the tarsus visible. Tarsi, 1-jointed, bearing a single, large, sharp claw, which is pale and bent sharply ventrad, the empodium apparently simple. Legs with sparse, stiff, long hairs; ambulatorial and subscansorial.

Abdomen fleshy, abruptly convex above, slightly concave below, widest at about the 4th segment; surface microscopically papillose, from naked eye smooth and shining. Cerci absent. Articulations indistinct. Scansorial.

Body marked as follows: Head, cervical and anal shields, legs, median line of abdomen, stigmata, and most of the tubercle areae, black; trochanters pale. The tubercle areae are arranged as follows: —

Segment I—As in instar II.

II—As in instar II; an additional flat round area, rotato-rugose, just above the large area, and in dorsal region, 2 transverse areae, at cephalic and caudal margins of the segment respectively.

III—Same as in instar II; with the additions as noted for segment II.

IV—Same as in instar II. Two additional areae in a longitudinal line just above each spiracle, coalesced, forming a crescent; in dorsal region, 4 areae, the first 2 coalesced, arranged in an irregular square, on each side of meson.

V–IX—Same; the two above the spiracle on segment 3, with an arm joining them. The 2 cephalic ones in dorsal region not coalesced; the cephalic one in that region minute, the next twice larger, and the 2 caudal ones subequal, at least 7 or 8 times larger than the cephalic one.

X—The same. The 4 in dorsal region closer, the 2 cephalic ones nearly in a transverse line at cephalic margin of segment; the 2 caudal ones, included with the cephalic margin of the anal shield, which covers portions of this segment, caudad.

XI—Tubercles still closer together, those above, in the shield; areae smaller. Apparently the same.

Instar II. Length after exclusion — 2.80 mm., avg.
Length before ecdysis — 5.3 mm., avg.
Width of head — 1.09 mm., avg.

Following the first ecdysis, the whole body is a bright crimson, the head and prothorax brighter, the ocelli and most of the tubercle areae black. Exuvium entire, black.

The same. Body more tubular (dorsal aspect); from lateral aspect, ventral surface nearly regularly concave, the dorsal surface convex, the convexity abruptly broken at segments 2 and 3, which are concave; from dorsal aspect, body narrower at thorax; widest at 2nd abdominal segment, and subacute at anal extremity; declivous at 5th or 6th abdominal segment.

Head the same, more rounded posteriorly, black, nearly as wide as the thorax, bearing scattered minute tubercles from each of which arise single, moderately long setae; head hispid, surface subscabrous. Ocelli inconspicuous; antennae the same, inserted below the center of the face, the first joint pale, the third joint pale at apex, the appendix pale; antennae retractile. Mandibles the same, relatively broader, darker, subtriangular, the outer margin subsinuate and more straight, the inner emarginate, the teeth stronger, the outer one slightly shorter, the inner or 4th more obtuse, nearly truncate. Maxillary palpi with basal joint pale. Clypeus broad and narrow.

Thorax narrower than in instar I, in proportion to body; the same. Legs the same, stouter, the claw fuscous.

Abdomen convex, oval, naked, ambulatorial, but with a single pair of prolegs situate at anal extremity; segmentation more or less distinct, ventral surface concave; ninth segment prehensile. Anus terminal. Cerci absent.

Body marked as follows—Head, cervical shield, some of the tubercle areae, legs, and anal shield, black, the latter rather dusky; cervical shield paler, subochreous near cephalic margin; remainder of the body ochreous. The prominent black tubercles and spiracles are arranged as follows: —

Segment I — The oval, dusky spiracle is on lateral aspect, contiguous to the base of the leg.

II — 2 areae on lateral aspect in a line cephalo-caudad, the more dorsal one larger; 4 on the dorsum in a square; 2 linear areae on each side of the meson.

III — The same; the two lateral areae in a line ventro-dorsad, the dorsal one much larger.

IV–XI — Lateral aspect, two large rounded areae in a line ventro-dorsad, subequal, forming a double line of dots along the side of abdomen; the dorsal ones are spiracles. On segments IX, X, and XI, paler, brownish, the dorsal areae much smaller (minute on XI and near anal shield), but more black.

Remaining areae very minute, but a longitudinal line on sides of ventum of abdomen are inclined to be conspicuous (segments IV–X). Anal shield quadrate, including segments XI and XII, forming a rectangle on each segment. A median line of black, fading caudad.

Instar III. Length after exclusion — 5.45 mm., avg.
Length before ecdysis — 8.50 mm., avg.
Width of head — 1.67 mm., avg.

The same. Dorsal body more convex, the 2nd and 3rd thoracic segments inclined; widest at third abdominal segment.

Head relatively wider, at least five times wider than long, anterio-posteriorly, its greatest transverse diameter just caudad of the insertion of the antennae; sculptured into irregular polygons by fine lines. Ocelli black, convex. Antennae, maxillary and labial palpi, the same. Mandibles stronger, more broad and triangular, the teeth forming a broad apex, rather than a fourth side; the 2nd tooth by far the largest, the 4th or mesal one truncate. Clypeus with three equal tubercles in an oblique (cephalo-laterad) transverse line, on each side of the meson, each bearing a single seta. Mandibles black along their outer edges.

Prothoracic segment much the largest, the shield peltate, emarginate along caudal margin; second segment at times partially concealed. Stigmata of prothorax round, large black areae, more caudad. Legs the same; tibia rectangular, slightly longer than the femur, and at least one-third narrower; claw and empodium orange yellow; coxa large and conical; trochanter subtriangular.

Abdomen the same, more convexed, prehensile, thicker laterad than dorso-ventrad; segmentation more distinct, surface minutely papillose, from naked eye, smooth.

Body markings the same, more distinct. Cervical shield bordered with ochreous at cephalic margin, involving also portions of the lateral margins, anteriorly; portions of the legs ochreous. Stigmata in large, oval, glabrous black areae, simulating coalesced tubercle areae, as in instar II. Tubercle areae the same, the anterior pair on dorsum of 2nd and 3rd thoracic segments subobsolete; the lateral areae on abdomen subequal.

Instar IV. Length after exclusion — 9.00 mm., avg.
Length before ecdysis — 15.00 mm., avg.
Width of head — 2.50 mm., avg.

The same. Prothoracic segment conspicuous, much wider than segments 2 and 3, and often completely concealing segment 2. Body widest at segments 3 and 4 of abdomen; more elongate, with the ventral surfaces more straight or flat, and with the outlines from dorsal aspect sinuate. Convexity of dorsal surfaces less apparent.

Head more conspicuous, more round, nearly one-half narrower than the first thoracic segment, oval in actual outline; its greatest transverse diameter passes between the caudal and the intermediate groups of two of the ocelli; face engraved, sculpture of head slightly stronger. Ocelli and antennae the same, black. Mandibles fuscous, darker at the teeth, at base nearly as wide as long; teeth stouter and less acute.

Thorax less inclined, the prothoracic segment from dorsal aspect conspicuous, wider than the two following segments, the shield covering most or whole of the dorsal surface, and overlapping much of the mesothoracic segment, and lateral aspect of segment 1, twice wider than long and not emarginate at is caudal margin. Legs the same, the coxae of the second and third pairs not as large as those of the foreleg. Body of claw straight.

Abdomen the same, less convex dorsad, and more flat ventrad, very prehensile; more corrugate.

Body markings the same. Median line of head and thorax ochreous, that of abdomen, dusky. Face ochreous, or mostly so, and also most of the occipital region of the head. Cervical shield concolorous with body, bordered caudad with black, its caudal edge ochreous, Stigmatal areae larger, conspicuous, glabrous black, irregular, equal or subequal on first 4 abdominal segments, slightly smaller on the fifth, one-third smaller on the sixth, two-thirds smaller on the seventh, and on the eighth abdominal segment minute, partially concealed in the incision of segment 7. Anal shield black. Proleg orange. Coxae and trochanters concolorous with body, as is also the mentum.

First pairs of tubercle areae on dorsum of meso- and metathoracic segments inconspicuous, sometimes apparently obsolete; the dorsal one on lateral aspect of the same segments more prominent, conical. The line of small areae on ventro-lateral aspect of abdomen less distinct. Shields of legs black. There are three small round tubercle areae also visible on the caudal margin of the 7th abdominal segment, on each side of the median line, just cephalad of the anal shield; they are flat, rotato-rugose. They are also present on the cephalic margin of that segment, observed when that margin is visible.

Just previous to pupation the body of the larva becomes contracted, and the prothoracic segment swollen; the body is also more convex, and the legs are applied close to the ventum. The colors fade slightly. The larva is then perfectly motionless in its cell in the ground.

Described from a lot of 10 larvae reared under similar conditions.

Duration of larval instars. Three separate lots were reared with this object in view, comprising a total number of nineteen larvae. Two lots were run together in field and laboratory and practically agreed in the duration of the different instars. The third lot (lot No. 2 in the table), was not supplied with soil after the third ecdysis, and pupated nakedly, apparently after the normal period, thus giving the actual length of instar IV. It is interesting to note in this connection that the time of ecdysis for lots of larvae of the same age was nearly simultaneous, all molting within a period of three or four hours.

Table III. Duration of larval instars.

Lot No.	No. larvæ	Date of Hatching	1st Ecdysis Instar I	2nd Ecdysis Instar II	3rd Ecdysis Instar III	Entered Soil Instar IV	Sums
1[1]	5	P.M., May 26	A.M., May 29 2½ days	P.M., May 31 2¼ days	A.M., June 2 2¾ days	P.M., June 5 3¾ days	11¼ days
2	9	6 A.M., June 16	12-30 P.M., June 18 2 days, 6½ hours	3 P.M., June 20 2 days, 2½ hrs.	4 P.M. June 22 2 days, 1 hour	7 A.M., July 1[2] 8 dys., 15 hrs.	15 dys., 1 hr.[3]

Additional records of the actual length of the combined larval instars made in the first two weeks in June, ranged from 16 days, 5 hours to 17 days, 9 hours, the records obtained from but three larvae.

Time in soil previous to pupation. Two records of this give 2 days, 16 hours as the time spent by the larva in the soil previous to pupation. This, of course, varies much with the individual, and we are inclined to think the period somewhat longer on an average.

Eating of eggs in confinement by starved larvae. Whenever egg-masses were brought in from the field and confined in the laboratory, the young larvae finding no food after hatching, would invariably turn their attention to the yet unhatched eggs in the mass, and commence to feed on them. We have seen the entire mass thus destroyed by one or two prematurely hatched larvae.

THE PUPA.

Description. Length, 9.20 mm., average; greatest width, 6.40 mm., 1st abdominal segment. Broadly ovate, angular, convex above, straight or slightly concaved below; naked. Color orange yellow, abdomen, wings, and legs orange, the median line of abdomen deeper orange; setae brownish; eyes change from pale to crimson and then, after 36 to 48 hours, to orange, with discal surfaces dusky; prothoracic tubercles black; a broad dusky line on dorso-lateral aspect of segments 2 to 5 of abdomen, not contiguous to the spiracles; spiracles black; tip of cremaster black.

Antennae inserted so that at least one-third, the whole of the basal third, is visible from ventral aspect, and from dorsal aspect, its apical third; they cross the base of the eyes and proceeding caudo-laterad (ventral aspect), go beneath the femora of the first and intermediate pairs of legs, where they are almost hidden; their tips reach to the knees of the intermediate legs. Articulation distinct.

Elytra large and rather conspicuous, their basal half plainly visible from ventral aspect, and from dorsal aspect, a longitudinal half of their base is visible. They extend caudo-laterad and then ventrad, between the intermediate and posterior legs. Their tips are opposite to the penultimate tarsal joint of posterior legs. The antennae reach to about their middle and are applied to them.

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[1] Duplicated in the field.
[2] Actual pupation.
[3] Actual length of the combined instars, including time in soil previous to pupation.

Stigmata of prothorax visible from ventral aspect; ovate. Those of abdomen visible from dorsal aspect, smaller and rounded oval, those of the first abdominal segment partially concealed.

Setae generally absent, except as mentioned in following; irregular, of medium size, and generally originating from distinct tubercles or papillae.

From dorsal aspect.— Head entirely concealed by prothorax, the latter visible for caudal two-thirds. The knees and tips of the femora of the first and intermediate legs project side by side, from the center of their respective segments; the knees of the first pair of legs are slightly caudad of the insertion of the elytra; those of the intermediate pair are slightly cephalad of the center of the elytra, and are advanced farther laterad; more of the femur of the first pair of legs is visible. The knees of the third pair of legs project from beneath the elytra at the third abdominal segment; the knee alone is visible. The elytra are visible for at least their basal three-fourths. Other appendages not visible. The cremaster visible for its entire length.

Prothorax semicircular in outline, the cephalic edge slightly concave, the lateral edges truncate, the caudal edge curved, and convex at median line; surface convex, with a thin median furrow. About one-third wider than long. In the disk, on each side of and along the median line, the pronotum bears about 13 to 15 rather conspicuous setae arising from small black tubercles; and the entire margins bear many setae, which are inclined to be grouped at the angles. At the dorso-lateral aspect, there is also a group of less conspicuous setae, of 5 or 6.

Mesothorax as wide as the prothorax, but nearly one-third shorter; nearly three times wider than long. The scutellum regularly peltate, convex, transversely striate, naked. Devoid of setae.

Metathorax slightly wider than prothorax, and about twice longer than mesothorax; with a deep median furrow. Surface glabrous. The thorax about equals the abdomen in length; the segmentation is not distinct.

Abdomen with greatest transverse diameter in the third segment. It tapers but slightly cephalad, but rather abruptly caudad, after the 5th segment, reaching a point in the cremaster. Setae are borne on the caudal margins of the segments, few mesad, numerous laterad, and thick near the spiracles. Segmentation distinct. Seen from lateral aspect, segments 1 to 6 are ridged the ridge cushion-like, and with a deep impression in the disk. Cremaster fleshy, turned dorsad.

Ventral view.— Head semicircular, with a thin median furrow, the tips of the mandibles reaching a point opposite the insertion of the first pair of legs; front impressed, with long scattered setae which are not present on the vertex, except laterally. Surface of the eye punctate. The large distal joint of the maxillary palpi is visible, and also the tips of the distal joint of the labial palpi. Each mandible bears at its extremity an acutely conical process, fleshy like a nipple. The maxillary palpi reach the tarsi of the first pair of legs.

Legs compact, the first and intermediate pairs with their femora contiguous. The tarsi of the first pair are applied to the base of the tarsi of the intermediate pair. The tarsi of the posterior pair project from beneath the elytra; the tips of the tarsi of the intermediate pair, which run parallel to the elytra, are applied to the tarsi of the posterior pair. Setae on legs sparse, mostly on knees and tarsi. Ventum of abdomen mostly concealed, a portion of the disk visible.

External development. There are no marked color changes in the pupa during the period just previous to exclusion to the adult. Following pupation, the colors are brighter, and the markings more or less faded, but this is not particularly striking.

Duration of Instar.

1. *Actual Duration.* The table which follows gives the actual length of the pupal instar, obtained by allowing larvae to pupate in vials without soil; in three cases, records were obtained by observations on larvae which had pupated at the sides of glass jars filled with soil, and these in nowise differed from the other records, ranging from six to eight days. The actual pupal instar and the time spent in the soil are very different in duration, and hence should be considered apart.

Table IV. Actual Pupal Instars.

No.	Pupated	Excluded	Length; days	hrs.
1.	5 P. M., May 25th.	6 A. M., June 1st.	5	13.
2.	6 P. M., May 26th.	7 A. M., June 1st.	5	14.
3.	10 A. M., June 10th.	4 P. M., June 16th.	6	6.
4.	10 A. M., June 10th.	Noon, June 18th.	8	2.
5.	7 P. M., June 18th.	2 P. M., June 25th.	6	19.
6.	11 P. M., June 19th.	Noon, June 23rd.	3	13.
7.	11 P. M., June 19th.	11 A. M., June 25th.	5	12.
8.	Noon, July 4th.	10 A. M., July 9th.	4	22.
		Sums.	46	5
		Average.	5	19

2. *Length of time in Soil.* Records of this are tabulated, for convenience of comparison with the table just presented.

Table V. Actual Time Passed in Soil.

No.	Entered soil for pupation.	Emerged.	Length; days	hours.
1.	10 P. M., May 22nd.	7 A. M., June 2nd.	10	9.
2.	10 P. M., May 22nd.	6 A. M., June 2nd.	10	8.
3.	10 P. M., May 22nd.	6 A. M., June 2nd	10	8.
4.	10 P. M., May 22nd.	3 P. M., June 3d.	11	17.
5.	8.30 P. M., June 8th	8 P. M., June 23d.	14	23½.
6.	3 P. M., June 11th.	5 P. M., June 21st.	10	2.
7.	2 P. M., June 11th.	9 A. M., June 23d.	11	19.
8.	5 P. M., June 11th.	11 A. M., June 22nd.	10	18.
9.	Noon, June 12th.	9 A. M., June 23d.	10	21.
10.	P. M., June 11th.	P. M., June 22nd.	11	
11.	4 P. M., June 11th.	Noon, June 22nd.	10	20.
12.	3 P. M., June 11th.	10 A. M., June 22nd.	10	19.
13.	2 P. M., June 11th.	7 A. M., June 24th.	12	19.
		Sums.	146	15½
		Average.	11	7

Length of time in soil after eclosion. Two records obtained, give this period as 3 days, 12 hours, and 4 days, 8 hours respectively. By comparing these with the tables in foregoing, they are apparently about correct, the average being about three and a half days.

THE ADULT.

Changes in color following eclosion. The changes in coloration undergone by the adult immediately following eclosion, have already been amply described and figured (Tower, 1903), so that no mention of them will be made here.

Length of life in confinement. We have but a single record of this, for a pair of adults captured *in copula*, 5 P. M., May 20th, and at once confined with food. The male died on June first, having lived 12 days. The female lived until June 7th, or 18 days. As already intimated, we may expect a much longer length of life than this, as both adults were probably some days old when captured.

Copulation and oviposition. The female of this pair deposited 525 eggs from May 21 to June 5th, in masses ranging from 9 to 53 eggs each, and with an average of 29.1 eggs to the mass. The daily rate of deposition was about the same as the average number of eggs per mass. Thus she averaged daily a mass of 29.1 eggs.

During the period of confinement, the pair were observed *in copula* no less than eleven times, or nearly once daily. On May 20th, they were observed to mate three times, and twice on the day following. Then again on May 23rd, and then once daily from May 26th to May 30th, inclusive. The act is normal for the Coleoptera.

Length of life cycle. The lengths of the different stages have already been tabulated. Taking the averages from these and combining them we get the average length of the life cycle, as follows: —

Length of the egg stage —	4 days, 23 hours
Length combined larval instars —	11 days, 6 hours.
Length time in soil —	11 days, 7 hours.
Average length of life cycle,	28 days.

Number of Generations in Georgia. Unfortunately we were unable to gather any definite data bearing on this, but our observations lead us to believe that there are at least three full generations of this insect in this locality of Georgia. This statement is made with qualification.

Natural enemies. During late May, an adult of *Sinea diadema* Fabricius was captured with a larva of instar III impaled on its beak. The body of the larva was partly collapsed. In confinement, this same individual Sinea destroyed several other larvae in different instars. We are indebted to Mr. Otto Heidemann, United States National Museum, for the determination of this insect.

No true insect parasites were met with.

LITERATURE REFERRED TO.

1903. Tower, W. L. The development of the colors and color patterns of Coleoptera, etc. Decennial publications, University of Chicago, X, 40 pp., 3 pls.

These notes are published through the kindness of Dr. L. O. Howard, chief of the Bureau of Entomology, U. S. Department of Agriculture.

PODISMA AUSTRALIS NOM. NOV.

Strict rules of nomenclature seem to require a different name for the species described (Psyche, xiii, p. 120, 1906) as *Podisma scudderi*, in consequence of the fact that *Melanoplus scudderi* was once referred to this genus (Walker, Cat. Derm. Salt. Brit. Mus., iv, 718).

A. P. Morse.

ON SOME UNRECORDED GENERIC AND SPECIFIC NAMES.

BY A. N. CAUDELL, WASHINGTON, D. C.

Intentionally or otherwise a large number of generic names proposed by Gistel in his Mysteries of the European Insect-world[1] have never been recorded in any of our nomenclatures or indices. Most of the genera here proposed are not described but have one or more described species cited under them, which gives them a valid standing. Duplication of these names is certain, sooner or later, to result in confusion and to prevent, so far as possible, such duplication some bibliographer, preferably a coleopterist, should go over the work and list such new or emended generic names as seem eligible for recording. All the valid generic names used by Gistel in this work as new or emendations, nearly 250 in number, are coleopterous except *Cephalomantis* and *Chersomantis*, both Orthopterous. These two genera are established on page 427 and are from Egypt. *Chersomantis* bears no generic description but the single included species, *picta*, is briefly defined as "antennis crassis; alis inferioribus basi adustis." *Cephalomantis* is described at some length and under it are listed two new species, the first, *rustica*, defined as "3″ lang; hellbraun" and the second, *gracilis*, defined as "Muschelbraun" and doubtfully referred to as a variety of the first. A third species, *viridipennis*, is included but, being undescribed except as characterized by the specific name itself, I consider it a nomen nudum. These two genera of Orthoptera are certainly well established and should be recorded.

Besides *Cephalomantis* and *Chersomantis* and their included species there are several other species of Orthoptera, as well as a number of species of other orders, here defined for the first time.

In Orthoptera the following new species are not found in Kirby's recent Universal Catalogue.[2]

Blatta pellucida	p. 427.	Mantis cinerea	p. 427.
" sphaerica	427.	" dilaticollis	427.
" pallida	427.	" maculipennis	427.
" elongata	427.	Forficula bicolor	427.
" lata	427.	" apicalis	428.
" hemialata	427.	Truxalis pharaonica	428.
Acrydium scutellatum	427.	Gryllus reticulatus	428.
" adumbratum	427.	" assimilis	428.
Tettix scabrata	427.	" nigrofasciatus	428.
Locusta oculata	427.	Gryllotalpa gracilis	428.

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[1] "Die Mysterien der europäischen Insectenwelt." Prof. Dr. Johannes Gistel. Kempten. 1856. 12mo, pp. 12 and 532.

[2] "A Synonymic Catalogue of Orthoptera." by W. F. Kirby. London, 8vo. vol. i.1904; vol. i. 1905; vol. iii. not yet published.

LIST OF RARER MOTHS TAKEN IN SHERBORN, MASS.

BY E. J. SMITH, NATICK, MASS.

Paonias astylus, June. A few each season.
Estymene prima, June, 2 ♂ 1 ♀.
Apantesis rectilinea, May June Aug.
" phyllira, middle to last of May.
" figurata, May, 8–14.
Charadra deridens, May-July.
Raphia frater, June, July.
Harrissimemna trisignata, July 17, one ♀.
Baileya doubledayi, July.
Hadenella numuscula, Sept. 11, 1 ♀.
Balsa labecula, May 18, one specimen.
Caradrina meralis, Sept. 15, one specimen.
Hadena didonea, July 7, one ♀.

This was identified by Prof. J. B. Smith who doubted the correctness of locality, as he had never heard of it from Mass., but there is no mistake in the matter. I took it at light.

Hadena leucoscelis, July 27, one.
Macronnoctua onusta, Sept.
Trachea delicata, July 7, one.
Homohadena badistriga, July 15, one.
Pachnobia monochromatea, May 24, June 25, both ♂s.
Porosagrotis tripars, Sept. 14, 1♂.
Euxoa bostoniensis, 1 ♀ bred. Date lost.
Mamestra rubefacta, June 14–18, 2♀.
Mamestra goodellii, June–Aug.
" anguina, June 1, 1 ♂.
" vicina, Sept.
Leucania extincta, June 14, July 1, 1 ♂-1 ♀.
Taeniocampa culea, June 1.
Xylina tepida, April 16, one sp. on Maple sap.
" baileyi, March, April, several both sexes on sap.
Tapinostola variana, July 20.
Fagitana littera, June, July.

Hydroecia u-album, May, June, Aug.
" speciosissima, Sept.
" rigida, Sept.
" impecuniosa, Sept.
Conservula anodonta, July 9, one.
Selicanis digitalis, Oct. 2, 6 specimens.
Derrima henrietta, July 31–Aug. 8.
Schinia spinosae, Aug.
" trifascia, July 24, one.
" nundina, Aug.
Autographa rogationis, one. Date lost.
" oxygramma, Sept. 24, one.
" ou, May 25, one.
" alias, Aug., one.
" epigaea, Aug. 28, one.
Paectes oculatrix, June 16–July 7.
Exyra rolandiana, July 10, one.
Melanomma auricinctaria, Aug.
Hormisa litophora, July, Aug., several.
" bivittata, July, several.
" orciferalis, June–Sept., several.
Dercetis vitrea, July.
Salia interpuncta, June, July, several.
Apatelodes angelica, July 12, 1 ♀.
Hyperaeschra georgica, June, several.
Odontosia elegans, July 11, one.
Janassa lignicolor, Aug.
Schizura apicalis, June 1, one.
Hyparpax aurora, June, several.
Cerura multiscripta, May 19. 1♀.
Fentonia marthesia, June 26, July 8. 1♂ 1 ♀.

Geometridae.

Dyspteris abortivaria, June–Aug., several.
Nyctobia fusifasciata, April 6, one.
Cladora atroliturata, April 21, one.
Lobophora montanata, May 8–31, several.

Euchoeca cretaceata, May 19–June 5.
Epirrita dilutata, Sept. 9, one.
Eustroma testata, Sept. 4–16.
Mesoleuca vasiliata, April 26–30, 1 pair.
Cosymbia albocostaliata, July 29, 1 ♂ 2 ♀.
Mr. Swett says this is the only record for the state as far as he knows.
Cinglis purata, Aug., several.
Orthofidonia exornata, June, one.
Sciagraphia continuata, May and Aug., several.
" mellistrigata, June 21, one.
Cymatophora brunneata, June–Aug., several.
Apaecasia deductaria, June 2, one.
Nacophora quernaria, June 14, 1 ♂.
Plagodis keutzingi, May, several.
" alcoolaria, June 2–10, 1 ♂–1 ♀.
" phlogosaria, July, several.
Gonodontis apiciaria, June, several.

A special meeting of the Entomological Society of America will be held in Boston about the 19th of August next, in connection with the Seventh International Congress of Zoology. Members are urged to be present and to contribute to the program of the meeting.

In order to facilitate the work of the Executive Committee in arranging a program, abstracts of proposed communications should be mailed to the Secretary,

J. Chester Bradley, Berkeley, California.
(After July 15th, Cornell University, Ithaca, N. Y.)

69 MOTHS TAKEN IN ONE HOUR — 41 SPECIES.

BY C. V. BLACKBURN, STONEHAM, MASS.

The following moths were actually taken in one hour (midnight) at 2 arc-lights, June 22, 1906.

Theretra tersa (rare)	1	Halisidota tesselaris	3
Ampelophaga chœrilus	3	Acronycta dactylina	1
" myron	2	Arsilonche albovenosa	2
Sphinx drupiferarum	2	Mesolomia iris	1
" gordius	1	Catocala nubilis	1
Lapara bombycoides	1	Homoptera edusa	1
Paonias myops	3	" cingulifera	1
Samia cecropia ♂	1	Hyperæschra georgica	1
Callosamia promethea ♀	1	Symmerista albifrons	3
Actias luna ♀	1	Ianassa lignicolor	1
Telea polyphemus ♂ ♀	2	Hyparpax aurora	1
Hyperchiria io ♀	1	Heliomata cycladata	1
Eacles imperialis ♂ ♀	3	Nacophora quernaria	1
Dryocampa rubicunda ♂	2	Gonodontis hypochraria	1
Haploa militaris	4	Lacosoma chiridota (rare)	2
Hyphantria cunea ♀	1	Euclea delphinii	1
Diacrisia virginica ♂ ♀	3	Prionoxystus robiniæ ♀	3
Isia isabella ♂ ♀	2	Sesia acerni	1
Apantesis phyllira ♂ ♀	4	Sthenopis argenteomaculatus	1
Euchætias oregonensis	1	micros (unidentified)	3

VANESSA MILBERTI IN BOSTON.— Thinking it might be of interest to the readers of PSYCHE, I write to say that in coming down Joy Street, Boston, April 18th, I saw a *Vanessa milberti.* This butterfly alighted so near to me that there could be no possible question of its identification.— JOHN LOWELL.

PROCEEDINGS OF THE CLUB.

The 263d meeting (also the Annual Meeting) of the Cambridge Entomological Club was held in the rooms of the Appalachian Mountain Club on Tuesday, January 15, 1907, at 7.45 P. M., with President Field in the chair and twelve members present.

Officers for 1907 were elected as follows: H. H. Newcomb, President; F. C. Bowditch, Treasurer; C. A. Frost, Secretary; A. C. Sampson and L. W. Swett, members at large of Executive Committee.

After the election of officers, the retiring President gave a very interesting address on the Mating of Saturniid Moths. The priority in emergence of the male imago was well illustrated by curves plotted from records of various species.

Mr. Frank A. Bates told of his observations on the Japanese moth, *Cnidocampa flavescens*, recently found abundantly in parts of Dorchester.

Meeting adjourned at the usual hour.

The 264th regular meeting was held in the rooms of the Appalachian Mountain Club on Tuesday, February 19, 1907, with President Newcomb in the chair and twelve members present. The President presented to the Club a gavel made from the stair-railing of Faneuil Hall, the wood being over two hundred years old . . . .

A drawing of an abnormal spider, sent in by Mr. Emerton, was shown. The specimen was taken at Long Island, Portland, Maine, and was a female *Drassus saccatus* with one male palpus.

The topic announced for discussion, Rare Insects of Eastern Massachusetts, was next taken up by President Newcomb who exhibited specimens of *Pieris protodice*, *Lepisesia flavofasciata*, *Citheronia sepulcralis*, *Terias lisa*, and as his rarest capture, *Pamphila ocola*, a southern skipper not recorded north of southern Pennsylvania. He took this insect in Milton in a secluded meadow not accessible to traffic. Mr. Sampson remarked that he had taken seven specimens of *Terias lisa* in Sharon in one season.

Mr. Rogers exhibited *Paonias astylus*, *Conservula anodonta*, *Euthyatira pudens*, *Feralia jocosa*, *Homoptera benesignata*, *Plusia balluca*, *Zeuzera pyrina*, *Euptoieta claudia*, and a bred specimen of *Laertias philenor*, all from Medford, Mass. *Zeuzera pyrina* was also reported from Jamaica Plain and Dorchester by Mr. Low and Mr. Lucas respectively. Mr. Frost reported the capture of a male of the same species in Medford on July 1, 1903, at light.

Mr. E. J. Smith sent in a long list of rare Lepidoptera which he had captured in Natick.

Mr. Johnson showed a box of rare Diptera, most of them from the southern part of Mass.

Mr. Frost exhibited a specimen of *Cicindela purpurea*, variety *audubonii*, a black form not recorded, so far as he knew, from New England or the eastern part of the U. S. It was taken in October, 1904, at Framingham, Mass., and was the only one in about five hundred specimens taken during that year. He showed a green form of *purpurea* approaching the western variety *graminea*, and a specimen of *C. scutellaris*, variety *unicolor*, an immaculate aberration taken among a large number of the variety *rugifrons* at Framingham, Mass. He also showed a specimen of *Prionus pocularis* from the same locality, and one of *Stromatium pubescens* taken at light in Bedford, Mass., by L. W. Swett.

The 256th regular meeting was held at the usual place on Tuesday evening, March 19, 1907, with President Newcomb in the chair and nine members and one visitor present . . . .

Mr. Johnson spoke of the summer meeting in Boston of the Entomological Society of America, and read a letter from Professor J. H. Comstock in regard to it. Suggestions for entertaining the Society were discussed by the members.

Mr. Field gave a very interesting talk on the subject of Experimental Entomology. He reviewed some of the recent literature of the subject, and exhibited a number of books. Mr. Field commented on the frequent use made of insects in the investigations of biologists, and the important contributions to entomology made by scientists who did not call themselves entomologists.

President Newcomb started a discussion of mimicry in insects, arguing that the oft-quoted mimicry of *Anosia plexippus* by *Limenitis archippus* is a fallacy. He had experimented by feeding plexippus to a golden robin and also to blue jays in captivity, and said that these birds had shown no hesitation about eating the insect. Several members expressed a doubt that the attacks of birds upon butterflies were sufficiently frequent to bring about such a case of mimicry.

Mr. Johnson exhibited a specimen of a wingless Tipulid, *Chionea valga* Harris, taken by Mr. Emerton on the snow at Jackson, N. H.[1]

Mr. Sampson spoke of the tenacity of life of lepidopterous larvae under certain conditions. He had recently sent eggs of *Hemileuca maia* to Arizona, and they had hatched soon after arrival. Then they were returned, and having no food for them he placed them in a cold room, where the last one died at the end of three weeks. He also told of a larva of *Automeris budleyi* that had lived five weeks after the last moult without any food, and died without pupating.

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[1] See Psyche, XIV, p. 41, April, 1907.

Meeting adjourned at the usual time.

A special meeting of the Club was held at the usual place and time Thursday evening, March 28, 1907. President Newcomb was in the chair and there were eleven members and four visitors present.

Mr. H. H. Lyman of Montreal, the guest of the Club, read a paper on *Thecla calanus* and *T. edwardsii.* He held the two to be distinct and well marked species and gave the bibliography, synonymy, and description of the two species. The chief difference between them, he said, was in the extra mesial band of the under side of the secondaries. He exhibited a series of each species and pointed out the differences to the members.

Dr. Fernald, State Entomologist, from Amherst College, was unexpectedly the guest of the Club and addressed the meeting upon several subjects. He told of some pupa-grafting experiments which were performed under his direction by a Japanese student at the College. Nearly all the pupae so treated lived and the imagoes emerged, but in a crippled or undeveloped condition. Dr. Fernald also told of the capture of an abnormal *Papilio turnus* at Orono, Maine, many years ago. It had normal fore wings but no hind wings and its flight was very peculiar.

A discussion of freezing of insects, and freak forms, followed among the members.

Mr. Emerton exhibited some bottles of Neuroptera from Three mile Island, Lake Winnepesaukee, N. H., which were named by Prof. Needham.

Mr. Field spoke of his experiments on selection of color by pupating larvae of *Vanessa antiopa* and gave some results of his work.

Adjourned at 9:50.

C. A. Frost, *Secretary.*

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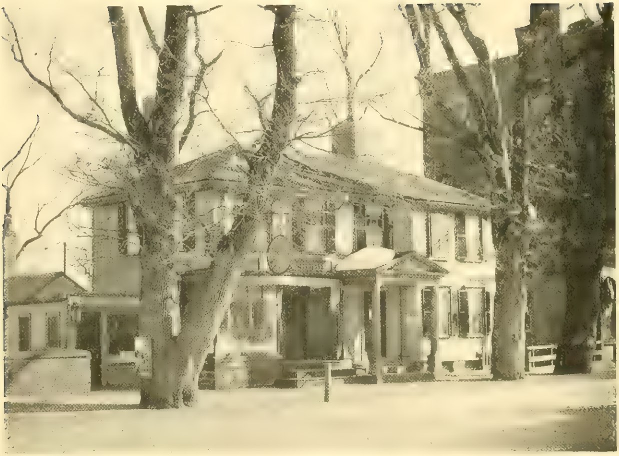

Copyright, 1905, F. A. Frizell.

The Milton Home of Thaddeus William Harris.

THE HOME OF A FAMOUS ENTOMOLOGIST.[1]

Just south of Boston, in the suburban village of Milton, is the house in which Thaddeus William Harris lived during those fruitful years when he divided his time between the practice of medicine and the study of entomology. In this house he established his famous collection — in its day probably the best arranged in America — and wrote the first description of many important American insects. Here he accumulated volumes of accurate records of his observations, and made with his own hand long transcriptions from borrowed copies of books which he could not purchase. Though the classic "Treatise on Insects Injurious to Vegetation" was not written until after Dr. Harris's removal to Cambridge, it was during his residence in this house that much of the material for it was gathered.

The house has had an eventful history, and has been a familiar landmark to Bostonians for a hundred and thirty years. The attention of the passer-by is attracted to it by the fine old elms by which it is sheltered, and by a marble tablet setting forth the fact that it was here that the famous Suffolk Resolves were adopted, in 1774, by a meeting over which General Joseph Warren presided. No tablet tells of its having been the home of one of the pioneers of American Science; but residents of the village long cherished the memory of the kindly country doctor who for sixteen years lived and worked among them.

Dr. Harris has been aptly called "the Gilbert White of New England." To every naturalist the scene of his patient labors is historic ground.

W. L. W. F.

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[1] Mr. F. A. Frizell of Boston has kindly permitted the use of the cut here presented.

TWO NEW MYRMECOPHILOUS HISTERIDAE.

BY H. C. FALL, PASADENA, CAL.

Some two years ago I received from Prof. Cockerell a specimen of a minute Hetaerius taken by him at Boulder, Colorado, in the nest of a species of Lasius. Quite recently two more examples have been sent me by Prof. Cockerell, who expresses the hope that I may soon describe it, and remarking that he considers it "one of the sights of Boulder." It is indeed a very interesting and distinct little species, and I take pleasure in complying with the request of its discoverer. Advantage is taken of the opportunity to present also a description of a still more remarkable Histeride from California, for which it seems necessary to erect a new genus.

Hetaerius minimus n. sp.

Form of *brunnipennis* but smaller and of somewhat paler color. Head and entire upper surface somewhat sparsely, evenly, and very distinctly punctate, each puncture bearing a suberect fulvous hair. Head not obviously concave. Prothorax transverse, sides straight, convergent from the base to the oblique truncation of the anterior angles; lateral portions of the disk divided by a tranverse impression at basal third, the posterior portion more convex, the anterior nearly flat, neither of them appreciably more closely punctured and pubescent than the median area. Elytra a little wider than the prothorax, marginal stria complete, the three discal striae fine, subequal in length, each nearly attaining the elytral apex. Propygidium sparsely finely punctate at base, becoming smooth at apex; pygidium impunctate or nearly so. Prosternum flattened and margined at summit from base two-thirds of distance to apex, the marginal lines sinuate between the coxae, diverging a little in front of them, and then converging and uniting just behind the subapical transverse impression; apical concavity of prosternum nearly horizontal. Femora about two-fifths as wide as long. Length $1\frac{1}{4}$–$1\frac{1}{2}$ mm.

Boulder, Colorado.

Three specimens from nests of "Lasius sp." May 2, and "*Lasius americanus*" March 23.

This is much smaller than any other known species of the genus in our fauna, but as already stated comes nearest *brunnipennis*. This latter differs in addition to size, in its much more remote and less conspicuous punctuation and pubescence, concave head, narrow femora, and in the form and length of the flattened area of the prosternum.

MELANETAERIUS new genus.

This name is proposed for a very singular insect which possesses the general structure and form of Hetaeririus, but differs remarkably in its blackish color and densely punctured integuments. The oblique impressed pronotal grooves so characteristic of Hetaerius are here wanting, and the elytra are completely devoid of discal striae. The prosternum is broadly flat at summit, the marginal lines diverging from between the coxae to the sharply impressed transverse line which delimits the broad anterior lobe. Front and middle thighs rather slender and subcylindrical, their tibiae narrower than in Hetaerius, with an angulate laminiform dilatation just beyond the middle. Hind thighs rather thick at base, narrowed from base to apex; hind tibiae strongly dilated and flattened, the surface convex on the outer side and concave within. The dilatation of hind tibia begins somewhat abruptly at about the basal fifth, gradually widening to apical fourth, where it terminates in an acute angle, then suddenly narrows to apex. Tarsi short, received in shallow excavations of the inner face of the tibial expansions in the front tibiae; in the hind tibiae this groove is deeper and occupies the outer edge from the angle to the apex; in the middle tibia the structure is intermediate in character. In other respects much like Hetaerius.

M. INFERNALIS n. sp.

Piceous, legs dark rufous or rufopiceous; upper surface densely punctate and rather dull, subglabrous. Head densely punctate, front concave. Prothorax two-fifths wider than long, sides nearly straight and slightly convergent from base to apex, front angles narrowly impressed and a little reflexed, side margin thickened and elevated, the thickened margin narrowed and interrupted at the middle; just within and opposite the point of interruption a rounded polished setiferous tubercle; disk broadly feebly convex and densely rather coarsely punctate; inner side of the thickened margin polished and impunctate. Elytra one-third wider than the thorax and nearly three-fourths as long as wide; widest at the humeri, sides thence slightly convergent and straight to apical third, apex truncate; surface densely rather coarsely punctate, with intermixed finer punctures; these latter sometimes between, sometimes within the rather shallow coarser punctures; disk without trace of striae, the marginal stria traceable toward the base; surface nearly glabrous, a few short stiff erect setae near the sides and apex. Propygidium densely punctate and with two subapical approximate tubercles; pygidium closely punctured at base, becoming gradually nearly smooth at apex. Body beneath closely punctured in great part, the prosternum very densely so, the abdomen more sparsely. Femora very densely subcribrately punctate and sparsely pubescent. Tibiae more sparsely punctured.

Length $2\frac{1}{4}$ mm., width $1\frac{3}{4}$ mm.

Pasadena, California, Dec. 1, 1902. A single example taken from nest of unknown ant.

THE ENTOMOLOGICAL SOCIETY OF AMERICA.

Program of the Special Meetings to be held in Boston during the week of the meetings of the Seventh International Zoological Congress.

Tuesday, August 20.

Field Meeting.—A special car will leave North Station at 2.15 p. m. for Saugus, where the insectary of the Gypsy Moth Commission will be visited. From Saugus special trolley cars will take the party through the badly infested region, giving an opportunity to see what is being done towards the extermination of the Gypsy Moth and the Brown Tail Moth.

Wednesday, August 21.

Meeting of the Executive Committee at 9 a. m., at the Harvard Medical School.

Thursday, August 22.

Meeting for the presentation of papers and for the transaction of business, 8 p. m., in the rooms of the Boston Society of Natural History. After this meeting a smoker will be given by the Cambridge Entomological Club.

THREE GALLS MADE BY CYCLORRHAPHOUS FLIES.

BY MILLETT T. THOMPSON, WORCESTER, MASS.

TRYPETIDAE.

IN Aldrich's "Catalogue of North American Diptera" eight species of the Trypetidae are recorded as gall-makers; viz., Trypeta baccharis Coquillett, T. notata Coquillett, Œdiaspis atra Loew, Œ. polita Loew, Aciura aplopappi Coquillett, Eutreta diana Osten-Sacken, Eurosta bigloviae Cockerell, and E. solidaginis Fitch. More complete knowledge of the life-histories of this family will undoubtedly increase the list. In each case the gall is formed on some Composite plant, three of the above species — Œdiaspis atra, Œ. polita and Eurosta solidaginis — attacking the genus Solidago. Material collected at Worcester Mass., during the past few months enables me to add *Eurosta reticulata* Snow, and *Eutreta sparsa* Wiedemann. Both make galls on the Golden-rod, and in this locality the galls have been found only on a large, smooth species, abundant in waste sandy fields, which I have not satisfactorily determined, perhaps Solidago juncea. But as these flies have a wide distribution, it is quite probable that other species also serve as the host-plant.

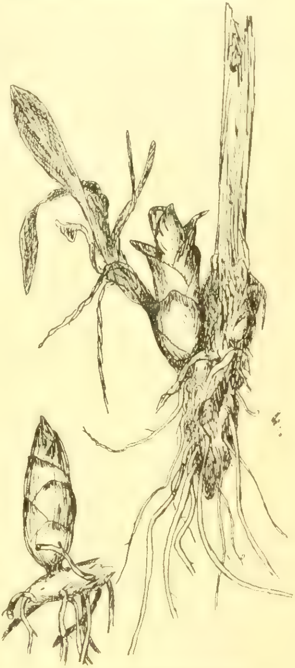

Figure 1. Gall of Eurosta reticulata.

Eurosta reticulata (Figure 1). The gall is a hollow cylinder, about two centimeters long by a half centimeter in diameter, evidently an aborted and transformed growing-shoot. The tip of the gall projects above the surface of the ground. Externally, traces of leaves appear in the form of imbricated scales, the uppermost of which may — particularly as the Spring advances — spread apart and show considerable green color. Within is a large cavity, opening above between the closely appressed, scale-like leaves at the summit of the gall. The walls of the gall are moderately thick, fleshy, and firm.

I first discovered these galls in the latter part of April, but even at that date the pupal stage had been attained. The formation of the gall and the growth of the larva must take place during the previous Fall, while the shoot is still very immature. In each gall the puparium lay in the upper part of the chamber. The flies emerged the last week in May and the first week in June. Many of the galls were parasitized by a large black Chalcis-fly.

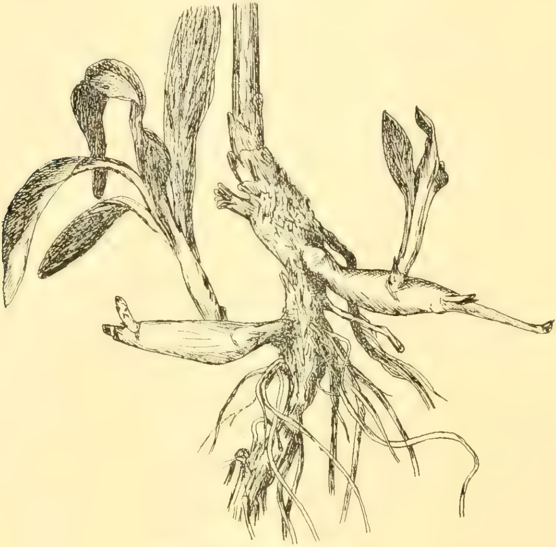

Figure 2. Galls of Eutreta sparsa.

Eutreta sparsa (Figure 2). While the gall of Eurosta reticulata projects above the surface of the ground, the gall of the present species is wholly underground. The injury here is likewise to the young shoots, but the gall is less specialized and

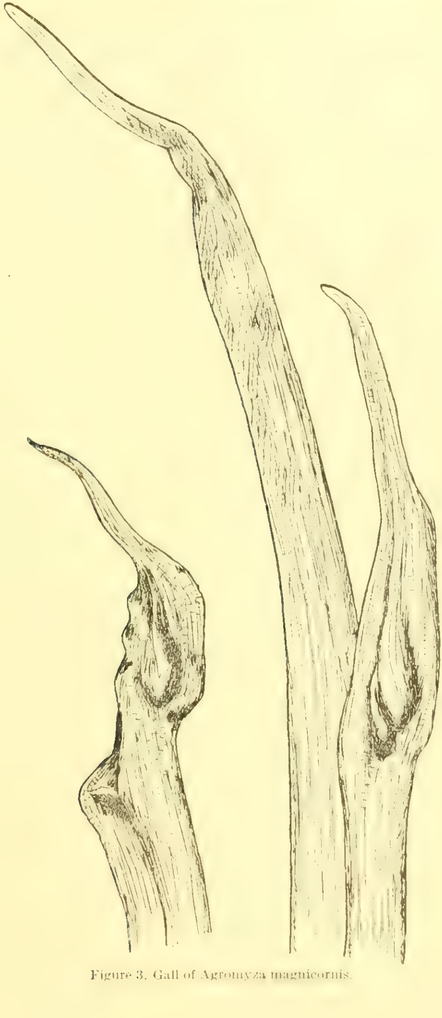

Figure 3. Gall of Agromyza magnicornis.

further growth of the shoot is not absolutely prevented. The gall indeed lies near the border-line between a true gall and such pseudo-galls as wood-inhabiting beetle larvae produce when boring in slender twigs. The larval chamber is small and irregular in form. Typically, the shoot swells and becomes a hollow, long-oval gall such as is shown in the figure. All forward growth of the shoot as a whole is stopped, but lateral reserve buds may grow and develop leaf rosettes. More rarely, only the proximal end of the shoot is affected, forming a short-oval or globular gall and the terminal bud develops normally. The long-oval galls usually measure 2 or 3 centimeters.

In April the gall of Eutreta sparsa was found to be of full size, but the contained larva was still small. The larva grew rapidly during May and pupated early in June. This stage lasted a little over two weeks, the flies emerging about the 20th of the month.

AGROMYZIDAE.

Agromyza magnicornis Loew. (Figure 3). When the leaves of the Blue Flag, Iris, are a few inches tall, the outermost leaf of the leaf-bundle is often found to be modified in so definite a manner that the resulting structure can be called a "gall." The leaf ceases to grow. The upper part broadens and also becomes thickened over a limited area, so that there is a very characteristic bulge on either side of the blade. If this be cut into,— even early in the Spring,— a small, oval, laterally compressed puparium is found. The flies emerge from these puparia about the last of May. This, I believe, is the first gall-like structure to be described for an Agromyzid, though the point of attack, the leaf, agrees well with the habits of other members of the Family, many of which mine the foliage of plants. As in the Trypetid galls already described it seems here that the larval life is completed during the previous Fall. But I have not as yet obtained data on this point.

The alteration of the outer leaf not infrequently injures the inner or second leaf of the leaf-bundle in a conspicuous way. The tip of the latter becomes caught in the malformed groove of the outer leaf and is held fast for a longer or shorter period. As a result the rapidly growing leaf is bent, and although it ultimately becomes free, yet the twisting produces a noticeable series of wavy folds.

I am indebted to Mr. C. W. Johnson of the Boston society of natural history for identification of the Trypetids and to Mr. D. W. Coquillett for that of the Agromyza.

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SOME NORTH AMERICAN SYRPHIDAE.

BY CHARLES W. JOHNSON, BOSTON, MASS.

PIPIZA FEMORALIS Loew, Centur., VI, 38.

THE species of the genus *Pipiza* as a whole, are quite difficult to determine. Dr. Williston's table, in his Synopsis of North American Syrphidae, would divide them readily into two groups—those with the "abdomen uniformly black," and those "with a basal interrupted yellow fascia." The type of *P. femoralis* Loew, consisting of a single specimen from Illinois, is characterized by having on the second segment, two large quadrate markings, very narrowly interrupted and formingaa broad fascia across the middle. On the other hand, these abdominal markings vary in size unttil they become obsolete or entirely wanting, in which case we have the *P. albipilosa* Williston.

A large series collected by the writer in the vicinity of Philadelphia, Pa. (the locality for the two types of *albipilosa*), shows that a large percentage have traces of, or quite prominent yellow markings on the second segment. The species was common at Arcola, Montgomery Co., Pa., April 27, 1894; later it was taken at Edge Hill, Pa., May 3, 1896; it was also collected by Mr. C. T. Greene at Lehigh Gap, Pa., July 1, 1903. Recently I have received from Mr. Germain Beaulieu, four specimens collected in Montreal, Canada, May 10 to 20, 1906, which show all gradations in the abdominal markings from the typical *femoralis*, to the more strongly marked specimens associated with *albipilosa*. Specimens of an intermediate character have also been received from Mr. S. A. Shaw, Hampton, N. H., May 17, 1904, and through Dr. W. E. Britton, collected by Mr. H. L. Viereck, at New Haven, Conn., May 7, 1905, and by Rev. H. W. Winkley at Branford, Conn., May 25, 1905. Mr. G. Chagnon, also collected it at Rigaud, Canada, May 28, 1899. I have collected the typical *albipilosa* at Auburndale, Mass., May 26, 1905.

There seems to be no structural character to separate the two; the dark tibial bands vary considerably in extent, being as a rule less prominent in the typical *femoralis*; the slight clouding on the middle of the wing is also variable; the whitish pile is noticeably longer on the male than on the female. Among the twenty specimens before me seven are females; four of these would be considered typical *femoralis* and three intermediate. Of the males four are typical *albipilosa* while eight are intermediate in character. The specimens vary from 7 to 9 mm. in length.

They have the habit of hovering in the air, in the woods, along the paths and roadways.

Pipiza radicum Walsh and Riley, is not related to this species, as is shown by Mr. D. W. Coquillett (Proc. Washington Entom. Soc., VI, p. 200, 1904).

PIPIZA FESTIVA Meigen.

P. festiva Meig. Syst. Beschr., III, p. 243, 1822; Williston, Syn. N. Amer. Syrphidae, p. 27, 1886.

Two female specimens which agree with the description of this species, were taken by the writer at the cascades on the road to Mt. Greylock, near North Adams, Mass., June 14, 1906. Comparing these with the specimen in the Museum of Comparative Zoology, from "Canada," referred to by Osten Sacken in his Catalogue as "*Pipiza festiva* Meigen (or a species closely allied to it)" proves them to be the same. There is also a specimen from Hallowell, Me., in the Harris collection, Boston Society of Natural History bearing the MS. name of "*binotata*."

That it is a variable species is shown by Schiner in his Fauna Austriaca I, p. 262, where he considers the *P. ornata*, *lunata* and *artemis* only variations. In general appearance it resembles *P. femoralis* but is readily distinguished by the dark smoky brown of the outer half of the wing; it is also a little larger, measuring about 10 mm., while *femoralis* averages about 8 mm. The locality "Canada" being questioned by Dr. Williston probably accounts for its omission by Prof. Aldrich from his Catalogue. The species has recently been recorded from Roca, Nebr., by Mr. Paul R. Jones (Jour. N. Y. Entom. Soc. XV, p. 89, 1907).

PIPIZA QUADRIMACULATA Panzer.

Syrphus quadrimaculatus Panz., Fauna Germ., LXXXVI, p. 19, 1803.

Pipiza quadrimaculata Meigen, Syst. Beschr. III, p. 249, 1822; Schiner, Fauna Austr., I, p. 262, 1862.

On June 8, 1898, I collected a number of specimens referable to this European species on the flowers of the Labrador tea (*Ledum latifolium*) near Ricketts, "North Mt." Pa., alt. about 2300 ft. The same species was collected on Mt. Greylock, Mass., June 15, 1906, at an elevation of 3535 ft. The specimens agree so closely with the description of this species, that there seems to be no doubt of their identity. The head, thorax and abdomen are a very dark bluish black, shining, with short thin hair; antennae brown; second and third segments of the abdomen, each marked with two yellow spots, those on the third being usually much smaller. Legs black, the knees and tarsi brownish, wings tinged with dark brown. Length 6–7 mm.

In the abdominal markings there is considerable variation. Among the eleven specimens collected the spots on the third segment show all gradations, from equal in size those on the second segment, to being obsolete and in one specimen wanting. The males have the most prominent markings.

PIPIZA AUSTRALIS n. sp.

Pipiza pulchella Johnson, Proc. acad. nat. sci. 1895, p. 329 (*non* Williston) ♂ ♀. Head, thorax and abdomen black or a very dark blue-black, shining, covered with a sparse whitish pile. Antennae brownish black, length of the third joint between four and five times its width, under side toward the base more or less reddish. Legs bluish black, tips of all the femora, basal half of the front and middle tibiae, the metatarsi and two following joints of the tarsi yellow; basal half of the posterior metatarsi and the two last joints of all the tarsi black. Wings dark brown, somewhat lighter towards the base, last section of the fourth longitudinal vein angulated in the middle. Length 6 mm.

Five specimens, St. Augustine, Florida, March 15, 1891. The length of the third antennal joint and venation induced me from the description, to refer it to *P. pulchella* in my paper on the Diptera of Florida. Since that time I have collected a number of the true *pulchella* and the distinctness of the two is very apparent. Its longer third antennal joint, dark brown wings and very dark blue-black body are the principal distinguishing features.

The genus is characteristic of the transition and boreal zones, this being the only species recorded from the lower austral.

CHRYSOTOXUM VENTRICOSUM Loew, Centur., V, 44, 1864.

Owing to a mistake in the habitat, there seems to be considerable confusion regarding this species. The two types are marked "W. T.," the original description gives "Washington." Osten Sacken, Catalogue, 1878, gives "Distr. Columbia," as does Dr. Williston in his Synopsis of the Syrphidae, p. 15 "District of Columbia (Lw.), Canada." The original description also calls for an inverted Y and not a V shaped marking on the fifth segment. It might be referred to either, it is really a very broad Y with a short stem. The scutellum of the types shows faintly the dark translucent disc so characteristic of all the species and cannot be called entirely yellow, as Loew's description ("scutellum totum flavum") would indicate. When you try to make eastern species fit the description of *C. ventricosum* you have "troubles of your own." The *ventricosum* of the New Jersey list should therefore be *C. derivatum* Walk. I have seen no specimens of *ventricosum* from east of New Mexico and Colorado. It is certainly very close to the *C. arcuatum* Latr. of Europe.

CHRYSOTOXUM PUBESCENS Loew, Wien. Ent. Monatschr., IV, 84, 1860.

The types of this species are both from "Ill." Specimens agreeing in every respect with the types are frequently taken throughout the eastern United States from Maine to Virginia. The inverted V and Y which has been used in describing the markings on the fifth abdominal segment, is apt to lead to some confusion in separating the closely related species *C. pubescens* and *C. laterale*; the former calls for an inverted V, the latter an inverted Y. This distinction however is not as clear as it seems, as it varies in the two sexes, being usually more V shaped in the ♂ and Y shaped in the ♀. This variation has also been pointed out by Mr. C. H. Tyler Townsend (Trans. Amer. Entom. Soc., XXII, 35, 1895). The type (♂) of *C. laterale*, from "Nebr." is readily distinguished by having the third, fourth and fifth segments broadly, laterally margined with yellow. A specimen (♀) from the same state shows a very slight indication of the margin being interrupted. A similar specimen from New Jersey, I have also referred to *C. laterale*. In the twelve specimens before me there is an indication that *laterale* may possibly prove to be only an extreme variation of *pubescens*.

CHRYSOTOXUM DERIVATUM Walker, List III, 542, 1849.

The type of this species is from "St. Martins Fall, Albany River, Hudson Bay." We should therefore expect specimens from the same faunal area to be more typical than those from more southern localities. A specimen from Grand Lake, Newfoundland, collected by Mr. Owen Bryant agrees more closely with the description than any other; between this specimen however and a series from N. H., Mass., N. J., and Penna, it seems to be impossible to draw a line notwithstanding minor discrepancies. The Newfoundland specimen is about 9 mm. in length (Walker's description calls for 3½ lines), the basal two-thirds of all the femora are blackish and the markings on the fifth segment can be described as "three large yellow spots." All of these characters are however extremely variable; the eight specimens which I refer to this species vary from 9 to 11 mm.; the specimen selected by Loew from the English River, Can., as representing this species, has the basal half of the femora black, while the two arcuate yellow spots on the fifth segment are narrowly connected with the central triangle. Two specimens from Mass. have only the basal third of the front and middle femora blackish, the basal half of the posterior femora being brownish; in one the brown forms a conspicuous middle band. A specimen from Franconia, N. H., collected by Mrs. A. T. Slosson has the posterior femora only slightly tinged with red towards the base; a similar specimen was collected at Folsom, Pa. Three specimens from Riverton, N. J., show only a slight basal tinge of brown on the front and middle femora.

CHRYSOTOXUM FASCIOLATUM Meigen. Syst. Beschr., III, 171, 1822.

In 1905 I received from Mr. H. H. Newcomb a large *Chrysotoxum* (♀), which he collected at Gold Rock (Rainy R. District), Ontario, July 21. While collecting on the summit of Mt. Greylock, Mass., July 15, 1906, alt. 3535 ft., I obtained after much difficulty, owing to their rapid flight and habit of poising in the air just out of reach of the net, a ♂ of the same species. Later I received from Mr. E. F. Hitchings two specimens collected at Hancock, Me., in June. That it was a species new to our fauna was readily apparent, but its determination was another matter; a new *Chrysotoxum* is not an inspiring thing, under existing conditions, and you feel like putting off the evil day.

An inspection of the Loew collection at the Museum of Comparative Zoology, through the kindness of Mr. Henshaw, revealed two specimens of this species, one marked "Mass.," the other "Can." and labeled "*fasciolatum* ? ". Lately I have received a specimen of this European species from Dr. F. Hermann, and find no character to separate the American specimens. Why was it not included by Loew and Osten Sacken in the Americana fauna? We can only account for it in this way,—Loew was describing only the new species. Osten Sacken may have overlooked it, or perhaps seeing the name questioned, thought it best to have its capture verified.

It is a conspicuous species measuring from 13 15 mm. in length, and readily distinguished by the wide black band extending entirely across the scutellum, leaving only a narrow basal and apical margin of yellow. None of the interrupted abdominal bands extend to the lateral margin, although in one specimen and in the one from Europe it is narrowly connected with the yellow at the posterior angle; the marking on the fifth segments might be described as a broad inverted Y. Basal half of the front and middle femora black, of the posterior femora brown.

Mixogaster breviventris Kahl.

M. breviventris Kahl, Kansas Univ. Quart., VI, p. 137, 1897.

A male and female of this interesting species were collected by Mr. Erich Daecke, at Lucaston, N. J., August 27, 1905. The type, a female, was described from Lawrence, Kans. The male differs but little from the female except that the fourth segment is nearly twice the length of the third, the posterior border on both being greatly dilated towards the lateral margins; the fifth segment and hypopygium (in the specimen before me) seem to be injured or forced within the abdomen, so that they cannot be accurately described.

TRICHOGRAMMA PRETIOSA RILEY: SEASONAL HISTORY.

BY A. A. GIRAULT, WASHINGTON, D. C.

The paper here presented for publication is one of a series on this insect based on observations and studies made during the Cotton Bollworm Investigations in Texas in 1904, by the U. S. Department of Agriculture. The observations were made in the laboratory at Paris, latitude 33°, 45′ north and the host of the parasite was *Heliothis obsoleta* Fabricius, unless otherwise stated in the text. In their report on the bollworm, Quaintance and Brues (1905) have already given the substance of much that is to follow, but I believe the observations of enough importance to justify elaboration, an impossibility in connection with an economic report of that kind.

Number of Generations.

The species under consideration is a remarkable example of an hymenopterous insect having multiple generations, and to this fact may be largely attributed its efficiency as a parasite. From the beginning to the end of the breeding season of 1904, it was under constant observation, and in the laboratory many successive generations were bred, so that actual records were obtained for fifteen consecutive cycles from the latter part of May to the first week in November. In addition to this direct evidence, there was also obtained much supplementary data, which warrants a positive statement to the effect that there were at least eighteen distinct generations of the little egg-parasite in the vicinity of Paris in 1904. The records show that the parasites began to appear about May 3rd, corresponding to the first noticeable appearance of the host eggs on corn, and they were present throughout the season in increasing numbers until about November 20th. To obviate further unnecessary discussion and for the sake of clearness and convenience, the generations are tabulated as follows:

Table I. Generations at Paris, Texas, 1904.

Generation No.	Eggs deposited.	Adults out.	Approximate length of cycle.	Sums of effective temperature.
1.	May 3	May 16	13 days.	324.1° *Fahr.*
2.	May 16	May 26	10 “	313.2
3.	May 26	June 6	11 “	354.7
4.	June 4	June 14	10 “	318.4
5.	June 14	June 22	8 “	297.2
6.	June 22	July 1	9 “	330.9
7.	July 1	July 9	8 “	298.9
8.	July 11	July 20	9 “	365.7
9.	July 20	July 28	8 “	300.
10.	July 29	August 6	8 “	298.7
11.	August 6	August 14	8 “	298.4
12.	August 14	August 23	9 “	364.0
13.	August 25	September 2	8 “	308.4
14.	September 2	September 11	9 “	308.
15.	September 11	September 20	9 “	314.2
16.	September 21	September 30	9 “	323.1
17.	October 1	October 14	13 “	408.1
18.	October 14	November 2	19 “	365.0
18a.	October 14	November 7	24 “	449.
18b.	October 14	November 8	25 “	465.
18c.	October 14	November 10	27 “	480.
Sums			254 days.	7285.0
Averages			12 days.	346.6° Fahr.

LENGTH OF LIFE CYCLE.

By consulting table I, it is seen that the developmental period of a generation varied considerably, from about 8 to 27 days, according to the season. Upon the approach of warm weather, it gradually decreased and remained practically constant from about the middle of June to about the middle of September, or during the warm summer months. In the fall, it rapidly increased in length, becoming twice as long in November as it was for the first generation in May, as would be expected from the fact that the mean daily effective temperature at that time of the year was very low. Table II is introduced to show as accurately as possible the lengths of the life cycles at different dates in 1904.

Table II. Lengths of the Life Cycle, Paris, Texas, 1904.

Lot No.	Dates.	Eggs deposited.	Adults out.	Approximate length of cycle.	
				Days.	Hours.
1.	May 3–May 16	May 3	May 16	13	
2.	May 26–June 6	P. M. May 26	Noon, June 6	10	21
3.	May 27–June 7	P. M. May 27	A. M. June 7	10	17
4.	June 1–June 12	A. M. June 1	A. M., June 12	10	17
5.	June 4–June 14	P. M., June 4	Noon, June 14	9	20
6.	June 14–June 22	A. M., June 14	A. M., June 22	7	22
7.	June 14–June 22	A. M., June 14	A. M., June 22	7	15
8.	June 20–June 28	A. M., June 20	P. M., June 28	8	6
9.	June 22–June 30	Noon, June 22	Noon, June 30	8	0
10.	June 22–July 1	P. M., June 22	A. M., July 1	8	14
11.	July 1–July 9	A. M., July 1	A. M., July 9	8	0
12.	July 20–July 28	P. M., July 20	A. M., July 28	7	19
13.	July 29–August 6	Noon, July 29	A. M., August 6	7	20
14.	Sept. 12–Sept. 20	P. M., Sept. 12	P. M., Sept. 20	8	0
15.	Sept. 21–Sept. 30	A. M., Sept. 21	A. M., Sept. 30	8	23
16.	Sept. 26–Oct. 4	A. M., Sept. 26	A. M., Oct. 4	8	6
17.	Sept. 28–Oct. 6	A. M., Sept. 28	P. M., Oct. 6	8	9
18.	Oct. 1–Oct. 14	Noon, Oct. 1	Noon, Oct. 14	13	0
19.	Oct. 14–Nov. 2	A. M., Oct. 14	A. M., Nov. 2	19	3
20.	Oct. 14–Nov. 7	A. M., Oct. 14	P. M., Nov. 7	24	6
21.	Oct. 14–Nov. 8	Oct. 14	Nov. 8	25	0
22.	Oct. 14–Nov. 10	P. M., Oct. 14	P. M., Nov. 10	27	0

The length of the life cycle was first recorded by Hubbard (Howard, 1892) in 1885 as being 7 days, the host being *Alabama argillacea* Hübner.

HIBERNATION.

Very little is known in regard to the mode of hibernation of many of the smaller parasitic hymenoptera, especially the more minute egg-parasites, and for this reason the following account will be of interest.

About two years before these observations were made, the method of hibernation of this species of Trichogramma was stated by W. A. Boucher whose account has not been accessible. However, Froggatt (1906) quotes Mr. Boucher as follows: "....As the parasite remains dormant in the egg of the Codling Moth[1] during the winter and spring months, it is evident that the number of parasites that will again be present at the commencement of each fruit season to continue the destruction of the Codling Moth's eggs will depend upon the number of parasitized eggs that remain uninjured during the winter, the proportion of which, under ordinary circumstances, and without artificial assistance, will be very small; ...."

Mr. Boucher apparently gives no evidence to show upon what his assertion is based and hence it needs confirmation. The following data obtained in the latter part of 1904 seems to indicate that his view is correct.

As shown in table II, the length of the life cycle increased rapidly in the fall from 8 days in late September to from 13 to 19 days in October, up to 27 days by the second week in November. In fact, the last or eighteenth generation varied unusually from 19 to 27 days, and the records show that this generation was a small or scattering one, the last principal generation being the seventeenth (adult about October 14). After about this date it is believed that hibernation commenced, though adults continued to be present, in rapidly decreasing numbers, for a month later (to November 19). In about the middle of October, and later, parasitized hosts in the field (including also *Alabama argillacea* Hübner) on corn and cotton were tagged and watched for emergence of the adults. Many of these were on dried and withered leaves when tagged, and when last examined after heavy killing frosts on November 20th, were found on these shriveled leaves, which were either hanging to the plants or were on the ground. Some of the parasitized hosts, however, had been washed from the leaves to the ground by the rain. The results are shown in the attached tables.

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[1] *Carpocapsa pomonella* Linnaeus.

Table III. Hibernation Statistics, Oct. 11–20, 1904.

Host, Lot No.	No. hosts.	Location.	Date tagged and known parasitized.	Hosts excluding parasites and date.	Hosts not excluding parasites by Nov. 20.	Total hibernating.	Condition when last examined (Nov. 20.)
1	2	Cotton leaves	October 11	2 — Oct. 19	0	0	
2	5	Dead corn leaves	12	0	5	5	Healthy.
3	3	Dead corn leaves	14	1 — Oct. 18	2	2	Healthy.
4	3	Cotton leaves	14	3 — Oct. 21	0	0	
5	4	Corn leaves	14	3 — Nov. 2–6	1	1	"
6	11	Corn leaves	14	11 — Nov. 2–15	0	0	
7	5	Corn leaves	14	5 — Nov. 7–10	0	0	
8	9	Corn leaves	17	8 — Oct. 20–Nov. 4	1	1	"
9	4	Young corn[1]	17	2 — Nov. 6	2	2	On ground; healthy.
10	3	Young corn[1]	19	0	3	3	On ground.
11	4	Corn	19	3 — Oct. 23–Nov. 4	1	1	Healthy.
Totals	53			38 — Oct. 18–Nov. 15	15	15[2]	Foliage wilted and dead.

[1] Planted for experimental purposes.

[2] 28.3 per cent.

Table IV. Hibernation Statistics, Oct. 21–Nov. 3, 1904.

Host Lot No.	No. hosts.	Location.	Date tagged and known parasitized.	Hosts excluding parasites and date.	Hosts not excluding parasites by Nov. 20.	Total hibernating.	Condition when last examined (Nov. 20).
1	6	Cotton leaves	October 21	1 — Oct. 23	5	5	Healthy
2	8	"	22	1 — Nov. 15	7	7	6 healthy; 1 washed off.
3	12	"	22	10 — Oct. 29, Nov. 14	2	2	Healthy.
4	12	"	22	4 — Nov. 4–7	8	8	"
5	14	"	24	0	14	14	11 healthy; 3 washed off
6	14	Young corn[1]	24	1 — Nov. 6	13	13	Healthy; 7 on ground.
7	1	"	24	0	1	1	On ground
8	1	Cotton leaves	24	0	1	1	Healthy.
9	3	"	25	0	3	3	"
10	6	"	28	0	6	6	"
11	10	"	Nov. 1	2 — Nov. 16	8	8	"
12	1	"	3	0	1	1	"
Totals	88			19 — Oct. 23–Nov. 16	69	69[2]	

[1] Planted for experimental purposes.

[2] 78.4 per cent.

Summary of Tables III and IV.

The tables serve to make clear the fact that at least as early as October 12th, hibernation had commenced, but that by October 20th only 28.3 percent were in that state, the remaining eventually emerging as adults. After October 20th, however, table IV shows that nearly 80 per cent of the parasites had not emerged up to the time of killing frosts (Nov. 20th and a few days earlier), or were hibernating. The data is not as conclusive as desirable, for it may be urged that the observations were not continued late enough to state definitely whether or not the adults issued after November 20th, and then hibernated. But as evidence against this, I offer the fact that adults failed to issue from 10 of these tagged hosts up to the middle of December, they having been carried to Washington, D. C., in vials and confined in the laboratory.

Another fact indicating hibernation as a larva in the host, is that no material increase in length of life could be noticed in the adults in the late part of October and in November. In reality, they seemed to perish more easily at that time than in the summer. During the observations, most of the adults issued during warm spells.

INCREASE IN NUMBERS DURING A SEASON.

Assuming that the average number of eggs deposited by a female is 30, a conservative estimate, and that at least half of these will produce other females, the progeny of a single pair for such a season as 1904 in Texas would total to the unthinkable number of 3, 031, 721, 260, 073, 800, 781, 250, as shown in the accompanying table by generations.

Table V. Progeny of a Single Pair, by Generations.

Generation No.	No. of descendants.	Remarks.
1	30	Descendants of hibernating female.
2	450	
3	6750	
4	101, 250	
5	1, 518, 750	
6	22, 781, 250	
7	341, 718, 750	
8	5,125, 781, 250	
9	76, 886, 718, 750	
10	1, 153, 300, 781, 250	
11	17, 299, 511, 718, 750	
12	259, 492, 675, 781, 250	
13	3, 892, 390, 136, 718, 750	
14	59, 885, 852, 050, 781, 250	
15	898, 287, 780, 761, 718, 750	
16	13, 474, 316, 711, 425, 781, 250	
17	202, 114, 750, 671, 386, 718, 750	
18	3, 031, 721, 260, 073, 800, 781, 250	

All of this, of course, is purely speculation, for we have no means of actually obtaining vital statistics of this kind. No allowances have been made for mortality in the reproducing females, or in the young, and in order to make the calculation as conservative as possible, the totals should probably be halved, on the theory that but half of the female descendants in any one generation survive to reproduce. This would still leave us in a maze of unthinkable totals. The figures are merely introduced to show the possibilities in rapid reproduction present in this important egg-parasite, and no claim is made that they represent anything like actual fact.

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FOUR USEFUL BOOKS.

THE increasing and welcome differentiation between manuals for the identification of insects on the one hand, and text-books for the study of entomology on the other, has already led many an amateur entomologist to seek a better acquaintance with biological literature in general; and gaining it, to find new significance in the common phenomena of insect life which he has been studying. Entomologists are more and more coming to be biologists.

Dr. Folsom's "Entomology,"[1] published more than a year ago, is an admirable treatise on insect life in its biological aspects. To students remote from the larger libraries it brings a masterly summary of a widely scattered literature. Its chapter on Anatomy and Physiology is full of valuable ideas for teachers, to whom the quality of the illustrations must particularly commend the book. Its very fair-minded presentation of the vexed subject of Adaptive Coloration will abate the prejudices and perhaps improve the judgment of those who adventure upon this tempting ground. The treatment of the inter-relations of insects and plants is so good that one wishes it were much more extensive. The fifty-eight pages of bibliography at the end of the volume would alone entitle it to a place in every entomologist's library.

The book contains few errors. A very obvious one is in the statement of the approximate number of species of Coleoptera, on page 18.

Professor Metcalf's "Organic Evolution,"[2] now in its second edition, is a very useful synopsis of current evolutionary theory. It is interesting to note how largely entomology has contributed to the evidence here brought together, though we may perhaps demur a little at the space given to those time-honored but dubious examples of "terrifying attitudes" furnished by the Lepidoptera. The author's own faith in them is not declared, but the pictures give them undue prominence. On the whole, however, the book is well-balanced, and should save its readers from some of those hasty interpretations of observed phenomena to which beginners are so prone.

The experimental work of Fischer, Standfuss, Pictet, Cuénot, Gräfin von Linden, Poulton, Crampton and many other investigators is concisely summarized, with admirable illustrations, in Professor Morgan's "Experimental Zoology."[3] The necessarily brief chapters are supplemented by excellent bibliographies. Every beginner in entomology who embarks upon experiments to ascertain the effects of heat, light, and changes of food upon insects, or attempts the breeding of hybrids, will find this book indispensable. Not only will it tell him what others have done in the same line; it will also give him a broad idea of modern experimental research and its attained results, and awaken in him a new zeal for the investigation of nature.

---

[1] Entomology, with special reference to its biological and economic aspects. By Justus Watson Folsom, Sc. D., Instructor in Entomology in the University of Illinois. Philadelphia: P. Blakiston's Son & Co.

[2] An Outline of the Theory of Organic Evolution, with a description of some of the phenomena which it explains. By Maynard M. Metcalf, Ph. D., Professor of Biology in the Woman's College of Baltimore. Second edition, revised. New York: The Macmillan Co.

[3] Experimental Zoology. By Thomas Hunt Morgan, Professor of Experimental Zoology in Columbia University. New York: The Macmillan Co.

For very practical service in enabling a novice to identify his captures or ascertain food-plants, Mr. Forbes's "Field Tables of Lepidoptera"[1] will be found of value. As now published in neat pamphlet form, these tables are an amplification of those given in Dr. Hodge's "Nature Study and Life." Though marred by serious typographical errors, and in places (as in the Glossary) by incompleteness of statement, the work exhibits many helpful features and much ingenuity of arrangement.

W. L. W. F.

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[1] Field Tables of Lepidoptera. By William T. M. Forbes. Worcester, Mass.: For Sale by Davis & Bannister.

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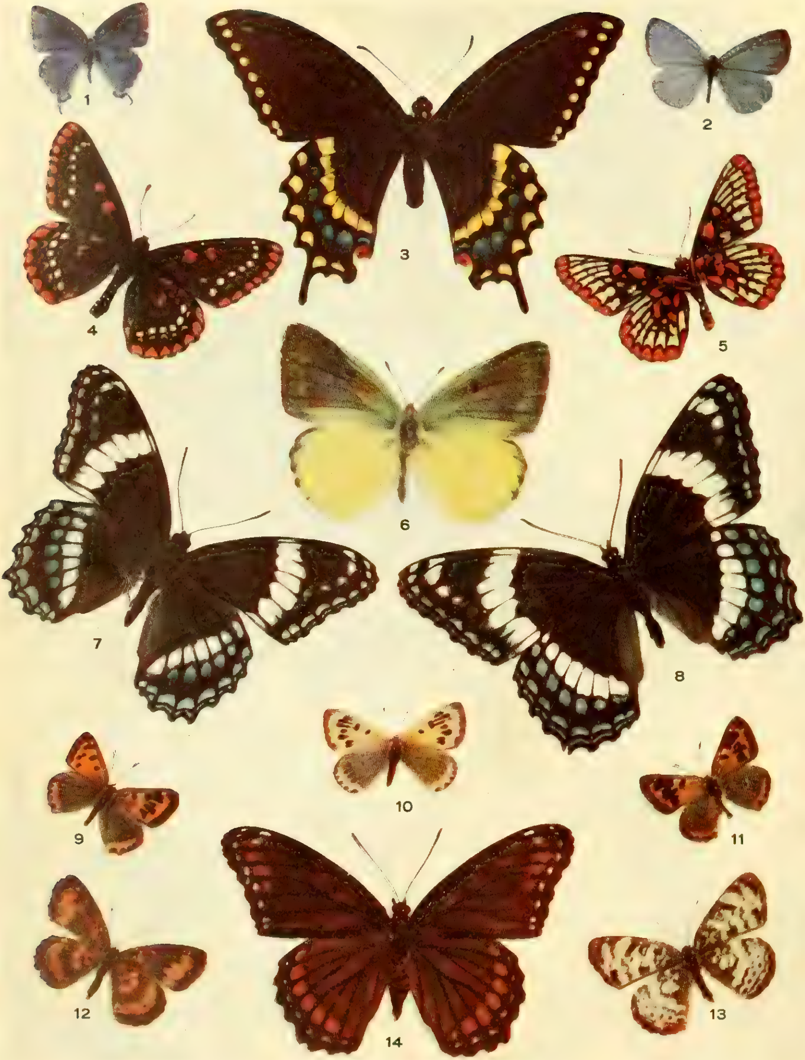

A FEW RARITIES

EXPLANATION OF PLATE II, WITH DESCRIPTION OF NEW VARIETY OF *LIMENITIS URSULA.*

BY H. H. NEWCOMB, BOSTON, MASS.

Fig. 1, *Thecla critola*, Hewitson, ♂, Patagonia Mts., Arizona. (E. J. Oslar.)

Fig. 2, *Lycaena pseudargiolus* var. *arizonensis*, Edw., hermaphrodite; left side ♂, right side ♀. Huachuca Mts., Arizona. (E. J. Oslar.)

Fig. 3, *Papilio polyxenes*, Fabr. ♂, aberrant; lacking the inner row of yellow spots across the primaries. Albany, N. Y. (J. H. Cook.)

Fig. 4, *Melitaea phaeton*, Dru., ♂, aberrant; having but one row of white spots across the wings and with the marginal lunules absent. Milton, Mass. (H. H. Newcomb.)

Fig. 5, *M. phaeton* var. *superba*, Strecker, ♂, (under side). Milton, Mass. (W. D. Denton.) I have another from the same locality on which the white is more diffused but less distinct.

Fig. 6, *Colias philodice* Godt. ♀ aberrant; the primaries being melanic. Sharon, Mass. (A. C. Sampson.)

Fig. 7, *Limenitis ursula* var. *albofasciata*, Newcomb, ♂. (Previously figured, uncolored, PSYCHE, Vol. XI, Pl. III.) Sharon, Mass. (A. C. Sampson.) See description on next page.

Fig. 8, same as above, ♀. Bedford, Mass. (L. W. Swett.)

Fig. 9, *Chrysophanus hypophlæus* Bdv. ♂ aberrant; left side normal, right side var. *fasciata* Streck. Sharon, Mass. (A. C. Sampson.)

Fig. 10, *C. hypophlaeas* var. *fasciata* ♀, albinic. Princeton, Mass. (L. W. Swett.)

Fig. 11, *C. hypophlaeas* var. *fasciata*, ♂, Wellesley, Mass. (H. H. Newcomb.)

Fig. 12, *Phyciodes tharos*, var. *packardii* Saund. ♂. Sharon, Mass. (A. C. Sampson.)

Fig. 13, *P. tharos*, Dru. ♀ albinic. I believe this example of albinism to be unique in this species. Dorchester, Mass. (H. H. Newcomb.)

Fig. 14, Limenitis sp. ♂. This butterfly which has been previously figured in Psyche (Vol. XI, Pl. 1, fig. 4) but uncolored, may be a cross between *archippus* Cram. and *ursula* Fabr. as suggested by Field (PSYCHE, Vol. XI, p. 1). There are certainly some grounds for this assumption: for instance the marginal row of white dots on the upper surface is distinctly traceable to *archippus*, while on the under side the ferruginous basal patches are characteristic of *ursula*. Except for the latter I should unhesitatingly say it was a suffused form of *archippus*. Taken at Sherborn, Mass., by the late A. L. Babcock in 1895 and presented to me by A. P. Morse. There is in the Academy of Arts and Sciences, Brooklyn, N. Y., a similar specimen taken by Ernest Shoemaker at Washington, D. C.

All of the above diurnals are in my collection.

L., ursula var. *albofasciata* new. (Plate II, figs. 7 and 8). A dimorphic form of *ursula* having a mesial white band, of varying width, extending across all the wings from near the middle of the costa to the inner margin of the hind wings about one-third the distance from the anal angle and reappearing on the under surface. Outside the white band, on the upper side of the secondaries, there is a row of light blue spots sometimes merging into a continuous streak. These are replaced below by the usual ferruginous spots of *ursula*. There is very little, if any, red on the secondaries above as on the *arthemis* ♂.

Habitat, so far as reported, Mass., eastern N. Y., and vicinity of Jersey City.

Types, 2 ♂ ♂ and 2 ♀ ♀ in my collection.

Co-types 1♂ and 1♀, Museum of Comparative Zoology, Cambridge, Mass., and 1 ♀, collection of Henry Wormsbacher.

This variety is readily distinguishable from the species it closely resembles, *L. arthemis* Drury, by one familiar with both insects. On fresh specimens the ground color of the wings above in the basal area has a very different tone. On *ursula* and its varieties there is a bluish cast while on *arthemis* the same dark or nearly black region has a brownish hue. Other points to be considered are size, habitat, width and position of the white band, the amount and shade of the blue on the secondaries above and as before indicated the presence or absence of red on males.

Proserpina Edw. is generally conceded to be a variety of *arthemis* (a view which I take), although some writers have suggested that it might be a hybrid with *ursula*. The strongest argument to support this theory is the fact that the ranges of the two species overlap. No such claim can be made with regard to *albofasciata*, however, as it has been taken in localities where *arthemis* is unknown, such as Staten Island, Long Island, N. Y., and Jersey City. It has also been taken near Boston. Has *arthemis*? It seems very doubtful. All the recorded captures I have been able to trace have turned out to be *albofasciata*. There are several such specimens in the Museum of Comparative Zoology at Cambridge — one from Malden, another from Wollaston, etc., wrongly identified as *arthemis*. We must, then, revise our records.

If *albofasciata* is a sport we should expect to find intergrades; and we do find them in abundance, from those having the merest trace of a white band across the fore wings to such examples as fig. 8. Fully 20 per cent. of the *ursulas* taken by me in eastern Massachusetts exhibit a tendency towards the development of this character.

It has been my privilege to examine a fine specimen of this variety, taken by Henry Wormsbacher near Jersey City, of which he writes as follows:—"The butterfly I captured has nothing to do with *arthemis*, but is a true *ursula*, more green in color like the form *viridis* and with broad white bands across the two wings. There are *no* markings whatever in the specimen which are found in *arthemis* and it is by all means a new variety. I do not think it necessary to make a sketch or photo of same, just take a greenish *ursula* ♀ and put white bands on it."

In view of the above facts and after several years of careful investigation, including the examination of scores of specimens, I am led to the positive conclusion that interbreeding of *ursula* and *arthemis* is in no way responsible for this variety.

THE NEWARK ENTOMOLOGICAL SOCIETY'S LOSS.

THE headquarters of the Newark Entomological Society on the fourth floor of the Newark Turn Hall was completely destroyed by fire in the early morning of June 3rd, 1907. The conflagration not only demolished the entire building but resulted in the loss of three lives.

The property of the Society consisted of a forty drawer cabinet containing one thousand specimens of Lepidoptera and two thousand five hundred specimens of Coleoptera, mostly representing local forms, besides a small collection in other orders; also a bookcase with one hundred and ten bound volumes and three hundred and sixty-five unbound volumes and pamphlets. All of this property was consumed by the flames except a few books that were in the hands of members. This collection was the accumulation of over twenty years of the Society's existence and as the loss is only partially covered by insurance it will be a long time before it can be replaced. Some of the books, perhaps, can never be obtained again.

The Society will be exceedingly grateful for any help in the way of rebuilding the library that may be given it. Entomologists are earnestly invited to send separates of their papers or other publications that they may have in duplicate for which the costs of transmission will be gladly refunded. Until the Society is again established in permanent quarters, parcels should be addressed to the secretary at New Brunswick, New Jersey.

JOHN A. GROSSBECK, *Sec'y.*

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—LXVIII.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Caberodes confusaria Hübner. Dr. Packard reproduces a figure of Abbot's as the larva of this species (Mon. Geom., pl. xiii, fig. 18); but, as appears from the text, this is the larva of *floridaria* Guen., and in any case does not agree with that of *confusaria*, having humps, whereas that is smooth. Mr. Bruce mentions (Ent. Amer., iii, 47, 1887) that the larvae were swept from clover, but gives no description. The present is, therefore, the first account of the larva.

Egg. Subcylindrical, the micropylar end evenly truncate, the flat area nearly as large as the central diameter; other end rounded, the two diameters nearly equal; about 20 longitudinal ribs, even, sharp, white crested, stopping at the edge of the truncation, slightly beaded; cross-striae fine, obscure; micropylar disk coarsely reticulated at the edge, finer centrally. Bluish green, turning to dull red, the ribs and reticulations white. Size, .9 × .6 × .5 mm. Hatched in twelve days.

Stage I. Head rounded, black, slightly shining, epistoma white; width about .5 mm. Body moderate, rather stout, the feet normal. Dark vinous brown, banded with grayish white; two narrow bands on thorax, between the feet a little irregularly edged and confusedly mottled; five abdominal transverse bands, half as broad as the intervening spaces, situated anteriorly on joints 5 to 9, cut by a narrow, thread-like subdorsal line, which widens at its posterior junctions with the dark areas; the bands are narrowed ventrally and divided by a broad adventral and narrow medioventral lines. A trace of a dark dorsal line, cutting the white bands anteriorly on the segments. Joints 10 to 13 with narrow subdorsal and broad blotchy subventral white longitudinal lines. Feet dark, concolorous.

Stage II. Head quadrate rounded, slightly bilobed, wider than high; vinous black, epistoma, antennae and two vertical mottled lines over the lobes white; width, .7 mm. Body moderate, feet normal, situated well posteriorly, segments annulate. Dark vinous brown; a dorsal row of semi-elliptical white spots, each cut from the truncated end by a dark line, on joints 5 to 9; large mottled lateral blotches, partly cut by the subventral fold; slight white mottling subdorsally especially on the tubercles of joints 2–5 and 10–13; venter dotted on the tubercles. Thoracic feet black; anal feet large, dark, with a white outer line. Setae inconspicuous; no humps nor elevations. A medioventral white band cut by a longitudinal line and the annulet incisures.

Stage III. Head rounded quadrate, wide; vinous black, a broad mottled erect white band on the face of each lobe, divergent below; a white triangle in the clypeus; epistoma and bases of antennae white; width, 1 mm. Body robust, weakly annulate, colored as before; the dorsal and other white patches more mottled and cut by the ground color, which is darker, vinous blackish. Tubercles in the lateral patches lumpy white.

Stage IV. Head as before, black, epistoma white, white diffused dottings broadly over the angles of the lobes and slightly in the clypeus; rounded quadrate, as high as wide, antennae and mouth dark; width 1.4 mm. Body moderate, normal, uniform; vinous black, annulate; dotted white subdorsal line on joints 2–4, a cordate white mark, containing a dark dot in each lobe on joints 5–10, centered by tubercle i, the white cut by the annulet incisures, obscurely joined by a geminate dorsal band posteriorly; on joints 10–13 a waved broken subdorsal band, roughly imitating the cordate marks; a series of segmental white patches on joints 7–9, joined by a broad white band on joints 8–12, becoming a narrower band anteriorly and posteriorly, running narrowly onto the foot on joints 10 and 13. Venter obscurely white streaked, with a pale medio-ventral band, dark centered; small white dots laterally, especially at tubercles ii and iii. Orange blotches in the white lateral markings. With growth the markings fade and become yellowish, but leave a bright white lateral spot on joints 5, 6 and 7, largest on joint 7.

Stage V. Head rounded quadrate, thick, as high as joint 2, scarcely bilobed; dull black, with angular white dots over the sides and in clypeus, forming a short black-dotted band on the vertices of the lobes; epistoma white; width, 1.8 mm. Body robust, uniform, feet normal; leather brown (dead-leaf) dotted with black; a waved smoky black subdorsal line, the cordate white spots lost in the brown ground, leaving only a little white mottling about tubercle i, and whitish bars on the otherwise concolorous cervical shield and anal plate; faint linear white lateral line, black edged; large white spots about the spiracles on joints 5–10, faint posteriorly, involving tubercle iii by a lobe; an orange spot about tubercles iv and v. Venter with numerous indistinct lines of blackish and brown, subgranular, dotted by whitish. Thoracic feet dark; the abdominal ones of joint 10 white lined, of 13 large, marbled, with a whitish band anteriorly that joins a faint stigmatal band composed of the confluence of the stigmatal patches on joints 9–13; a reddish tinged stigmatal band on joints 2–4.

Stage VI. Head rounded quadrate, thick, the vertex roundedly divided, level with joint 2; colored as before but the white more extended, so that the ground color is white with crinkled and dotted dark brown marks, which are confluent over the sides and broadly each side of the median suture, and form a border within the clypeus; eyes black, epistoma white, labrum brown, antennae white; setae short, brown, from small shining tubercles, normal; width, 2.4 mm. Body robust, cylindrical, uniform, tubercle i of joint 12 slightly enlarged, the thorax a little smaller, no humps. Coloration essentially as before; segments wrinkly annulate, smooth around the spiracles; carneous brown, olivaceous yellowish on the sides, shaded with blackish; thorax under lens pinkish white, dotted with brown-black, leaving subdorsal and stigmatal pale shaded bands, touched with ocherous; a square black patch laterally on joints 3 and 4; subventral region blackish shaded; feet dark brown. Abdomen dorsally (under lens) white, dotted thickly with ocherous and sparsely with black; a waved subdorsal black shade composed of dots and disappearing largely under a lens; sides olive shaded, a large white bilobed spot about tubercle iii and the spiracle, another on tubercle v and an ocherous one on tubercle iv, distinct on joint 6, fainter on joints 5 and 7, lost in a lilacine shade on joint 8 and running into a band on joints 9–13. Venter dotted, showing broad pale medio-ventral band, narrower dark one each side, narrow pale one, to a broader dark one over tubercles vi–vii, all rather evanescent under a lens; a straight subdorsal shade on joints 10–13, broken into oblique shades of dots; tubercle i of joint 12 white; anal shield and leg plates darkly marked on a white ground. Tubercles small, black; setae short, stiff, brown.

The larva spun a slight cocoon between leaves and pupated at once; adult issued in about four weeks.

Food plant, dandelion. The larvae were offered a variety of plants and chose this one. Probably they will eat a number of low plants. Larvae from Washington, D. C.

A LARGE number of European and American entomologists attended the summer meeting of the Entomological Society of America, held on August 22 in connection with the Seventh International Zoological Congress in Boston. The auditorium of the Boston Society of Natural History was well filled, and several very interesting papers were presented. Dr. Henry Skinner of Philadelphia presided. After the meeting the Cambridge Entomological Club entertained its guests at a smoker in the Grundmann Studios on Clarendon Street.

A REVIEW OF THE SPECIES OF THE GENUS BOMBYLIUS OF THE EASTERN UNITED STATES.

BY CHARLES W. JOHNSON, BOSTON, MASS.

SINCE making a study of the types of *Bombylius lancifer* O. S., in the Museum of Comparative Zoology, together with a comparison of the description of *B. mexicanus* Wied. and *philadelphicus* Macq., I find that there is a mistaken identification of two of our eastern species, and that the specimens referred to *B. lancifer* and *philadelphicus* in the New Jersey List, represent two undescribed species, while another undescribed form has been confounded with *fulvibasis* Macq. (= *atriceps* Loew).

Considering the apparently short duration of life of the adults of such readily recognized species as *B. major, pygmaeus, pulchellus* and *varius*, the time of appearance undoubtedly constitutes an important factor in determining closely related species. This feature requires a more careful study than I am now able to give, and while I have a large and carefully collected series, their relationship and time of appearance was not understood at the time they were collected. Owing to the fact that they are so easily denuded, specimens should be collected with the greatest care for denuded specimens are neither beautiful nor useful. Their life histories would also prove an interesting line of study. As far as known they are parasitic upon bees, chiefly *Andrena* and *Colletes*.

From the latitude of Philadelphia northward to Massachusetts the species can be divided provisionally into two groups:— those appearing in the spring, and those which appear in the summer; *B. major, pygmaeus, pulchellus* and *fulvibasis* representing the spring forms, and *B. mexicanus, incanus, fraudulentus, varius* and *subvarius* those of the summer. For *B. validus* I have no date of capture.

TABLE OF SPECIES.

1. Wings with the anterior half brown, which is sinuous and sharply defined posteriorly . . . . *major* L.
   Wings with the basal portion brown and spotted with brown posteriorly . 2
   Wings with the basal portion brown, which is gradually evanescent posteriorly 3
2. Wings with the spots more or less coalescent and forming three quite distinct oblique cross-bands . . . . *pulchellus* Loew.
   Wings with six or seven spots on the hyaline portion . . *pygmæus* Fab.

3. Pile grayish white *incanus n.* sp.
   Pile yellowish 4
   Pile yellowish, the black hairs predominating on the abdomen 5
4. Wings with the posterior portion strongly tinged with brown 6
   Wings with the posterior portion grayish hyaline 7
5. Sternum with black pile, large species, 12 mm. *varius* Fab.
   Sternum with white pile, small species, 6–8 mm. *subvarius* n. sp.
6. Proboscis nearly as long as the body, large species, 12 mm. *validus* Loew.
   Proboscis only one-half the length of the body, small species, 5–8 mm. *fraudulentus* n. sp.
7. Third joint of the antennae long and narrowly lanceolate, large species, 10–12 mm. *mexicanus* Wied.
   Third joint of the antennae more broadly lanceolate, small species, 6–8 mm. *fulvibasis* Macq.

Bombylius major Linn.

This is the most common and widely distributed of any of the species. It is found from the Gulf of Mexico to Canada, from the Atlantic to the Pacific, and throughout Europe and Northern Asia to Japan. In Louisiana it makes its appearance in March, in Colorado in April. In the vicinity of Philadelphia it is found from April 9, to May 19, depending on the season. Waltham and Wellesley, Mass., May 6 to 9.

Bombylius pygmaeus Fabricius.

This species as a rule seems to be more northern in its distribution, although recorded from Virginia. I have not been able to obtain the species south of New Jersey, Jamesburg, May 4, and Passaic Co. May 14. In Massachusetts the species seems to be quite common at Auburndale (Riverside) May 7, and Waltham, May 30. It has also been taken by Mrs. A. T. Slosson at Franconia, N. H., and by Mr. G. Chagnon at Montreal.

Bombylius pulchellus Loew.

A beautiful little species very common in the vicinity of Philadelphia, from April 29 to May 21, according to the season, but only remaining about a fortnight during any one year. I have a specimen from New York, collected by Mrs. Slosson, and have received specimens from Prof. C. H. Fernald, collected at Amherst, Mass., May 17 and 19.

BOMBYLIUS FULVIBASIS Macquart.

B. fulvibasis Macq. Dipt. Exot. V, 82, 1855.

B. atriceps Loew, Cent. IV, 49, 1863.

There seems to be no doubt that Macquart's name will have to be adopted for this species — "Long. 2¾, l. ♀. Trompe longue de deux lignes. Barbe blanche. Face d'un noir luisant. Front: le tiers antérieur d'un noir mat, à léger duvet fauve; les deux tiers postérieurs d'un noir luisant, à poils noirs." The size can only apply to this species and not to the specimen of "*philadelphicus*" which Baron Osten Sacken found with it — see O. S. Cat'l., note 159, p. 238.

This species which often closely resembles the following, is distinguished by its smaller size (6 to 8 mm.), duller yellow pile, with slight bands of black hairs on the abdomen, and the shorter and broader third antennal joint. Although widely distributed it seems to be quite local. I have only taken it at Clementon, N. J., where it can be obtained in great numbers on the flowers of the Sand Myrtle (*Leiophyllum buxifolium* Ell.), May 9-16. It has been collected by Mr. B. H. Walden at New Haven, Conn., May 25, by Dr. Geo. Dimmock, at Springfield, Mass., May 22 and by Mrs. Slosson at Charlotte Harbor, Fla.

BOMBYLIUS MEXICANUS Wiedemann.

B. philadelphicus Macq., Dipt. Exot. II, 1, p. 99, pl. VI, f. 3.

This is a larger species (10 to 11 mm.) than *fulvibasis*, with brighter and thicker yellow pile, black hairs rarely present, and a narrow lanceolate third antennal joint. It is usually found in the greatest number, about three weeks later than *fulvibasis*. It is represented in my collection by a specimen from Florida collected by Mrs. Slosson; Tifton, Ga., May 16 (G. R. Pilate); Ft. Washington, Md., May 26; Clementon, N. J., May 30; Riverton, N. J., June 9–16; Iona, N. J., June 8 (E. Daecke).

BOMBYLIUS INCANUS, n. sp.

B. philadelphicus Johnson, in Smith's Cat'l. N. J. Insects, p. 649 (not of Macquart).

♂. Face and front covered with dense silvery white hair, vertical triangle black, with black hairs, antennae black, the third joint narrowly lanceolate, proboscis about 3 mm. in length. Thorax grayish black, with white pile, the pile on the dorsum and scutellum less abundant and interspersed with black. Abdomen covered with long dense white pile, with a slight tuft of black hairs on the sides. A specimen from Provincetown, Mass., has two tufts on each side, the anterior one being more prominent and giving the appearance of a transverse band, although no black hairs are present on the dorsal portion. Legs yellow, coxae, bases of the femora, knees and tips of the tarsi dark brown. Wings with the anterior basal third, dark brown, varying somewhat in extent and intensity. The specimens from Groton, Mass., are noticeably darker near the veins, the posterior portion of the wing hyaline, with a slight grayish tinge. Length, 5–7 mm.

♀. Front grayish above the antennae, and with short silvery white hairs, upper part and vertex grayish pollinose with black hairs. The abdomen has two distinct bands of black hairs, the hairs procumbent, the brown area of the wings less profused and hardly extending beyond the middle of the first basal cell, in other respects resembling the ♂.

The records for this species are at present confined to two states. In New Jersey it was first taken by the writer at Jamesburg, July 4, 1893, on May 30, 1897, a single specimen was collected at Clementon, and on June 13 of the same year a number were taken at Atco. Since then (June 8, 1902) it has been collected by Mr. E. Daecke at Iona and by Dr. P. P. Calvert, at Albion, June 1. The first specimens from Massachusetts to come under my observation were two, badly rubbed, from West Chop, Martha's Vineyard, collected by Mr. Albert P. Morse July 4, 1893. On June 24–27, 1904, I collected a number of specimens at Provincetown, and at Groton, July 8, 1905. There is a rubbed specimen in the Loew collection of this species marked "sp. nova inad."

This interesting species I have always found under similar conditions, *i. e.*, hovering over or alighting on the gray white sand of an old roadway, the color of the sand and fly being very similar. It resembles *B. metopium* O. S. from California, but lacks the brown strip of hairs extending from the shoulders to the base of the wings and also the black femora of that species. Types (♂ ♀) from Provincetown are in the New England collection of the Boston Society of Natural History.

Bombylius subvarius n. sp.

B. lancifer Johnson. In Smith's Cat'l. N. J. Ins. p. 649, 1890 (not of Osten Sacken).

♂. Face reddish brown, shining, sparsely covered with long black hairs; frontal triangle covered with a brownish pollen and bearing long black hair; inferior orbits and cheeks white, with long silvery, white hairs; antennae brownish black, the third joint very narrowly lanceolate; proboscis 6 mm. in length. Thorax black, opaque, covered with a long erect dull yellowish pile, which is mixed with black on the post-alar callus and scutellum; lower part of the pleurae and sternum with white pile. Abdomen, base yellowish pilose with black predominating on the second and third segments, forming two broad bands, the black pile also predominating on the last segment; basal half of the venter white pilose, the remainder more or less blackish. Legs yellow, coxae black, knees and outer portion of the tarsi brown. Wings with the dark brown basal area quite clearly defined, extending into the discal and the first and third submarginal cells, the remainder of the wing grayish hyaline.

♀ Front covered with procumbent golden yellow tomentum and long black hairs (in denuded specimens shining black). The thorax, scutellum and abdomen beneath the thin yellowish and black pile, are covered with a procumbent golden tomentum, the white pile of the pleurae extending upward and forming a tuft in front of the wings. There are also tufts of white hairs on the sides of the first and fourth segments of the abdomen. Length, 7-8 mm.

Three specimens collected by the writer on the flowers of the New Jersey tea (*Ceanothus americanus*) at Morris Plains, N. J., June 25, 1892. Two specimens collected by Mr. H. L. Viereck at Lehigh Gap, Pa., June 26 and 29, 1901.

From the description, the ♂ of this species was inadvertently referred to *B. lancifer*. Its is however smaller and less robust, lacks the line of brown pile extending from the humeri to the wings, has narrower third antennal joints and a shorter proboscis. The male of this species resembles that of *varius* in miniature, but the pile of the sternum is white and not black, as in that species.

Bombylius varius Fabr.

This large and handsome species has been taken by the writer at the following localities: Glymont, Md., May 25, '96; Morton, Pa., July 7, '93; Westville and Riverton, N. J., June 15 to July 2. It was common at the latter place on the flowers of the "Red Osier" (*Cornus sericea*).

Bombylius fraudulentus n. sp.

♂. Face and front brownish black, opaque, with long black hairs, oral margin reddish, cheeks whitish with silvery white hairs; antenna black and narrowly lanceolate, proboscis about one half the length of the body. Thorax with long dense yellow pile, lower portion of the pleurae and sternum with white pile. Abdomen with yellow pile interspersed with black along the posterior margins of the third and fourth segments, forming more or less prominent bands; pile on the venter white. Legs yellow, extreme base of the femora, knees and terminal joints of the tarsi brown, coxae black. Wings a dark yellowish brown at the base, extending in a somewhat lighter brownish shade over the entire wing, which is narrow and gradually tapering towards the apex.

♀. Front slightly covered with a golden yellow tomentum, easily denuded, leaving the upper part a polished black. On the abdomen the long hairs are less prominent, and the entire surface is covered by a yellow tomentum, a dorsal line and spots of whitish tomentum on the sides of the third and fourth segments being sometimes quite prominent. Length, 5–8 mm.

This species has been collected at the following places in New Jersey:— Iona, June 2, '02, (*Daecke*); Atco, June 18, '93; Jamesburg, July 4, '94; Orange Mts., July 4, '96; Morris Plains, June 24, '92 and Dover, June 25, '92 (*Johnson*). In Connecticut, at New Haven, June 27 (*E. J. S. Moore*) and in Massachusetts at Springfield, July 2 and 10, '99; Mt. Tom, June 26, '00, and July 14, '05 (*Dimmock*); West Chop, July 4, '93 (*A. P. Morse*), Provincetown, June 27 and Hyannis Port, July 3, '04 (*Johnson*). In the list of New Jersey Diptera, this species was confounded with *subvarius* (*lancifer*). It can however be readily distinguished from both *subvarius* and *fulvibasis* by its dark evenly clouded wings, which are noticeably narrower and more gradually tapering, especially in the male, and also by the shorter proboscis. It appears in greater numbers at least a month later, than *fulvibasis*.

The types, (♂ Provincetown and ♀ Hyannis Port) are in the New England collection of the Boston Society of Natural History.

Bombylius validus Loew.

This large species I have not been able to obtain on any of my collecting trips, and there seems to be no date bearing on its time of appearance. It is widely distributed, being recorded from "Ga., Va., Ill., N. Y., and Montreal." I have a specimen marked "Tex.," (*Bolter*). It is readily distinguished by its noticeably long bright yellow pile and long proboscis. The dark brown of the wings extends in a slightly lighter shade over the entire surface.

THE SPHECODIDAE OF SOUTHERN MAINE.

BY J. H. LOVELL AND T. D. A. COCKERELL.

THE genus *Sphecodes* is represented in this locality by eight species, which have been collected chiefly in July and August. They visit a variety of flowers with easily accessible nectar, but the males have been found most commonly upon the inflorescence of Solidago. The species are very variable in coloration, sculpture and the venation of the wings. All of the species described in this paper have the mandibles bidentate. The Maine species may be separated by means of the following key:

FEMALES.

Mandibles black at base, rufous or rufescent at apices, size larger, over 6 mm. . . 1.
Mandibles mainly red or yellowish-red, the apices darker, size smaller, less than 6 mm. . . . . 2.
1. Abdomen wholly red, or segment 5 black, 9–10 mm. . . *dichrous* Sm. and *lautus*, *persimilis*, *obscurans* n. spp.
   Abdomen with segments 4–5 black, 6½–8 mm. . . . *prosphorus* n. sp.
2. Enclosure of metathorax reticulated, smaller . . . *mandibularis*.
   Enclosure with parallel rugae, larger . . . . . . *levis* n. sp.

MALES.

Wholly black, joint 4 = 2 + 3 . . . . 1.
Black and yellow or red, joint 4 nearly equals 3, small species . . . 2.
1. Larger, 8–9 mm. . . . . *dichrous*.
   Smaller, 6 mm. . . . . *prosphorus* n. sp.
2. Wings milky white . . . . *nephelotus* n. sp.
   Wings dusky . . . . 3.
3. Enclosure reticulated, mandibles reddish-yellow, with darker red apex, *mandibularis*.
   Enclosure with parallel rugae, mandibles dark with red apex . . *levis* n. sp.

There occur at Waldoboro a small group of bees consisting of *S. dichrous* and a number of closely allied varieties or species, three of which have been named and described in this paper. The precise status of these bees must for the present remain uncertain, as owing to their rarity only one or a few specimens of each kind have been collected; and also because all of the males obtained belong to a single species. Care is necessary lest the table of differential characters prove misleading, since mention of like characters is largely omitted; and unlike characters, which often require careful attention to be noted, are here readily perceived. In general appearance these bees bear a close resemblance, and their exact relationship can only be determined by a large series of specimens and much additional field study.

Entirely apart from the question of their validity as species the variations presented by these bees in the color of the wings, the color and punctuation of the abdomen, and in several minor particulars are of so much interest that they are worthy of description. They may be separated as follows:

Wings dusky, abdomen light red, segments 2–4 punctured all over. . *lautus* n. sp.
Wings reddish, abdomen darker 1

1. Segments 1 and 2 impunctate, or with a few minute punctures, clypeus densely and confluently punctured . . . . . *persimilis* n. sp.
   Segment 1 impunctate, segments 2–4 finely punctured on basal third, seg. 4 largely, seg. 5 entirely black . . . . . . *obscurans* n. sp.
   Segment 1 distinctly punctured, segments 2–4 with distinct punctures except on apical margins, sometimes a discal spot on segment 1 . . *dichrous* Sm.

SPHECODES DICHROUS Sm.

1853 *Sphecodes dichroa* Sm. ♀ (not ♂), Cat. Hym. Brit. Mus. 1: 38.

♀.— Length 8 mm. Head and thorax black, abdomen red, a black discal spot on segment 1, the 5th segment black. Face clothed with white hair, punctures on clypeus coarse and remote, front with large deep punctures. Mesothorax shining, with large widely separated punctures. Wings reddish, but less so than in *obscurans* or *persimilis*; tegulae dark, probably variable in color. Metathorax not strongly reticulated, the ridges chiefly longitudinal. Abdomen distinctly but not closely punctured, segment 1 with sparse, well-defined punctures; following segments with distinct punctures except on apical margins.

Taken on Crataegus coccinea, June 14. Another specimen collected on Cornus alternifolia, the last of June, is referred to this species, with which it agrees in most characters; but the discal spot on the first segment is wanting, or very obscure; and the area of the metathorax is more strongly reticulated.

♂.— Eight black males taken on Solidago, August 9, 11, and 17, are temporarily referred to *S. dichrous*. They vary in length from 7–8 mm., and some specimens are broader and more robust than others. The face and sometimes the clypeus is covered with white hair. The mesothorax is coarsely, but not densely punctured, except in front; the metathorax is shining, with short salient ridges, giving it an irregular pitted appearance. The wings vary from nearly hyaline, to hyaline with the apical margin distinctly clouded with red. The abdomen is very finely and rather sparsely punctured all over.

SPHECODES LAUTUS n. sp.

♀.— Length just over 9 mm. Head and thorax black; abdomen red, of a rather light tint, long and nearly parallel-sided, with the apical segment black. Wings hyaline basally, the apical half strongly smoky, with a dilute blackish, but not at all reddish or yellowish tint. Face covered with white hair. Mesothorax sparsely punctured, shining; area of metathorax strongly, irregularly ridged with no well-defined margin. Abdomen finely punctured, sparsely on basal segment, 2nd and following segments punctured all over.

One specimen on Spiraea salicifolia, August 4.

SPHECODES PERSIMILIS n. sp.

♀.— Length 9–10 mm. Head and thorax black; abdomen red of a bright chestnut tint, of normal shape, apical segment red. Wings very strongly reddened. Face with much white hair. Mesothorax densely and coarsely punctured; area of metathorax irregularly subcancellate. Abdominal segments 1 and 2 nearly impunctate, or with a few scattered punctures, basal part of apical segments with small punctures.

Two specimens on Umbelliferous flowers, July 14 and 19.

SPHECODES OBSCURANS n. sp.

♀.— Length about 8½ mm. Head and thorax black; abdomen dark red, the apical segment black, and the penultimate suffused with blackish. Wings very strongly reddish. Face with little hair. Mesothorax dull (probably due to moisture in cyanide jar), with sparse rather weak punctures; area of metathorax strongly reticulated, not well-defined. First segment impunctate, segments 2–4 with minute punctures only on the basal third.

One specimen on Aralia hispida, which blooms here in July. Two other specimens, also taken on Aralia hispida, July 7 and 16, resemble *S. obscurans*, but differ in several particulars.

In Can. Ent. 36: 232, 1904, there are described from Washington State a similar group of bees closely allied to *S. dichrous*, one of which (*S. arvensiformis* Ckll.) it is noteworthy has the wings dark and very yellow. A comparison of the differential characters of the four Maine species is as follows:

Character.	*S. dichrous* Sm.	*S. obscurans* n. sp.	*S. lautus* n. sp.	*S. persimilis* n. sp.
Head. Front.	Punctures large and deep with the shining intervals plainly visible.	Punctures very close and quite small, but very distinct. Short transverse head.	Punctures large.	Coarsely punctured, dull.
Eyes.	Black.	Paler.	Intense black.	Apparently brown in life, convex below.
Clypeus	Coarsely punctured.	Large punctures widely separated in the middle, a median sulcus.	Large punctures.	Densely and confluently punctured.
Wings	Reddened, but less so than in *obscurans* and *persimilis*.	Strongly reddish.	Dusky hyaline.	Strongly reddish.
Tegulae.	Dark.	Lighter.	Dark.	Lighter.
Mesothorax.	Shining, with widely separated punctures.	Dull, with sparse weak punctures.	Shining, sparsely punctured.	Densely and coarsely punctured.
Area of metathorax.	Ridges chiefly longitudinal, with a few cross ones.	Strongly reticulated, margin not well-defined.	Strongly, irregularly ridged, margin poorly defined.	Irregularly ridged.
Punctuation of abdomen.	Distinctly but not closely punctured 1st segment sparsely segs. 2–4 except on apical margins.	Segment 1 impunctate, segs. 2–4 with minute punctures on basal third.	Finely punctured segment 1 sparsely, segs. 2–4 all over.	Segments 1 and 2 nearly impunctate, segs. 3–4 with small punctures at base.

SPHECODES PROSPHORUS n. sp.

♀.— Length 8 mm. Head and thorax black; abdominal segments 1–3 dark red, very shiny, the apical segments black, or the fourth partly reddish. Face thinly clothed with white pubescence; densely and finely punctuated above the antennae and on the vertex; mandibles bidentate, black at base with dark red apices. Mesothorax smooth and shining, with sparse distinct punctures, the median sulcus evident. Wings dusky hyaline, with a distinct brown tint, stigma and nervures dark rufo-fuscous, tegulae rufo-fuscous. Enclosure of metathorax well-defined with a salient rim, shining, coarsely reticulated, the reticulations irregular in form but about the same size. Segment 1 with a few small scattered punctures; segments 2–3 with numerous fine punctures at base, the apical margins depressed, smooth and shining; segments 1–3 dark red; apical segments black; segment 3 in some specimens partly clouded with black.

♂.— Length 6 mm. Entirely black, resembles the male of *S. dichrous,* but is smaller with finer punctures; the apical margins of the abdominal segments are depressed, impunctate, and obscurely testaceous. One male taken on Solidago, Aug. 9, has only two submarginal cells.

The female was taken on Crataegus coccinea, June 14; the male on Aralia hispida, July 30; and Solidago Aug. 17. This species is allied to *S. dichrous*, but typical specimens may be easily separated by the smaller size of both sexes. It is a neater, more shining species with finer sculpturing, and in the female the abdomen is more largely clouded with black. A female from Spiraea salicifolia, July 30, is smaller and duller, the red of the abdomen lighter, with the black apex better defined, and the wings not so brown. It may represent a distinct species, but more material is necessary to decide this question. Compared with the various Rocky Mountain and Pacific Coast species, *S. prosphorus* is not much like any of them, but it has a very close resemblance to the European *S. gibbus*. The male of *gibbus*, however, usually has the abdomen red, except at base and apex.

Sphecodes levis n. sp.

♀.— Length about 5 mm. Head and thorax black; abdomen red with black apical segments; mandibles lively red with the base black, bidentate, the inner tooth small; antennae black, the flagellum faintly reddened beneath. Mesothorax shining, with rather large well separated punctures, the median sulcus distinct but shallow; wings dusky hyaline with dark brown nervures and stigma, tegulae testaceous in front, area of metathorax well-defined, semicircular with parallel longitudinal rugae, but not reticulated, though there are indications of cross lines, giving the rugae a sort of beaded appearance. Abdomen impunctate, segments 1–2 red, segment 3 suffused with blackish, apical segments black.

♂.— Length about 5½ mm. Head and thorax black; abdominal segment 1 black with apical margin yellowish-red; 2nd segment yellowish-red at base, sides and apex, center black; apical segments black. Breadth of head about equal to the length; mandibles black, rufous at tips; antennae black, joint 4 nearly equals 3. Mesothorax shining, rather coarsely punctured: semicircular enclosure of metathorax well-defined with parallel rugae. Wings a light shade of fuscous, stigma and nervures brown, tegulae black.

One female on Cornus canadensis late in June, male on Solidago bicolor. Readily separated from other Maine bees by the parallel longitudinal rugae of the metathorax.

SPHECODES MANDIBULARIS Cr.

1872 *Sphecodes mandibularis* Cr. ♀. Trans. Am. Ent. Soc. 4: 250.
1897 *Sphecodes mandibularis* Robt. ♀ ♂, Trans. Ac. Sci. St. Louis, 7: 317.
1903 *Sphecodium cressonii* Robt. ♀ ♂, Ent. News, 14: 106.

Two females collected on Solidago, July 27 and Aug. 7; the male on Solidago juncea, Aug. 7; Carduus arvensis, Aug. 6; and on Solidago, July 30 to Aug. 25. Of twelve specimens of the male all have the abdomen largely red. One male has the first transverse cubital nervure wanting in one wing and obsolescent in the other.

(The type of *S. mandibularis* Cr. is no longer in existence, but there is a cotype which Mr. Cresson regards as in all respects typical. The cotype, Mr. Viereck informs me, has the mandibles bidentate.— J. H. L.)

SPHECODES NEPHELOTUS n. sp.

♂.— Length 5 mm. Head and thorax black; abdomen largely red, but the apical margins of segments 1–3 are broadly reddish-yellow; on segment 2 the black is often reduced to a narrow, median strip, the base of segment 2 may also be yellow; segment 1 has the base always broadly black. Face clothed with dense, white hair; scape black, flagellum testaceous beneath, blackish above, joint 4 nearly equals 3; mandibles red, dark only at extreme base. Mesothorax shining, with fine, sparse punctures; wings milky-white, nervures and stigma pale brownish; tegulae testaceous; enclosure of metathorax well-defined, obscurely reticulated, the rugae tending to become parallel.

Fourteen males collected on Carduus arvensis, Aug. 6; Solidago juncea, Aug. 3–7; and Solidago, Aug. 17. Easily distinguished by the milky-white wings.

SPHECODES GALERUS n. sp.

♀.— Length 6½ mm. Head and thorax black; abdomen broad, first two segments and base of third dark red, apical segments black. Mandibles dark rufous apically; flagellum dull brown beneath; mesothorax coarsely and closely punctate, opaque; area of metathorax shining, strongly reticulated, with a prominent rim. Wings dusky hyaline, with a brownish tint, nervures and stigma very dark, second submarginal cell narrow, much contracted above.

One specimen from Hampton, New Hampshire, collected by S. A. Shaw, Sept. 9, 1905. Readily known from *S. prosphorus* by its smaller size and much more densely punctured mesothorax. In Robertson's table it runs to *S. clematidis*, but the mesothorax is not at all "strongly sulcate," the abdomen is different, and the nervures and stigma are much darker. The coarse, close punctures of the mesothorax, and the color of the mandibles readily separate it from *S. levis*. The larger size alone separates it at a glance from *S. mandibularis*.

THE NORTH AMERICAN SPECIES OF SPHECODES.

America North of Mexico.

Sphecodes antennariae Robt.

1891 *Sphecodes antennariae* Robt. ♀, Trans. Am. Ent. Soc. 18: 63.
1903 *Dialonia antennariae* Robt. ♀ ♂, Ent. News, 14: 105.

Sphecodes arroyanus Ckll.

1904 *Sphecodes arroyanus* Ckll. ♀, Ent. 37: 231.

Sphecodes arvensis Patton.

1880 *Sphecodes arvensis* Patton, ♀ ♂, Am. Ent. 3: 230.
1897 *Sphecodes dichrous* Robt. ♀ ♂, Trans. Ac. Sci. St. Louis, 7: 316.
1903 *Sphecodes arvensis* Robt. ♀ ♂, Ent. News, 14: 106.

Sphecodes asclepiadis Ckll.

1898 *Sphecodes asclepiadis* Ckll. ♀, Bull. Denison Univ. 11: 45.

Sphecodes arvensiformis Ckll.

1904 *Sphecodes arvensiformis* Ckll. ♀, Can. Ent. 36: 233.

Sphecodes clematidis Robt.

1897 *Sphecodes clematidis* Robt. ♀ ♂, Trans. Ac. Sci. St. Louis, 7: 320.

Sphecodes columbiae Ckll.

1906 *Sphecodes columbiae* Ckll. ♀, Can. Ent. 38: 280.

Sphecodes confertus Say.

1837 *Sphecodes confertus* Say, ♀, Bost. Journ. Nat. Hist. 1: 392.
1859 *Sphecodes confertus* Lec. ed. Say's Writ. 2: 771.
1865 *Sphecodes confertus* Sichel, ♀, Ann. Soc. Ent. Fr. 5: 454.
1880 *Sphecodes falcifer* Patton, ♀ ♂, Am. Ent. 3: 230.
1897 *Sphecodes confertus* Robt. ♀, Trans. Ac. Sci. St. Louis, 7: 319.
1903 *Drepanium falciferum* Robt. ♀ ♂, Ent. News, 14: 105.

Sphecodes davisii Robt.

1897 *Sphecodes davisii* Robt. ♂, Trans. Ac. Sci. St. Louis, 7: 319.

SPHECODES DICHROUS Sm.

1853 *Sphecodes dichroa* Sm. ♀ (not ♂), Cat. Hym. Brit. Mus. 1: 38.
1865 *Sphecodes dichrous* Sichel, ♀, (not ♂), Ann. Soc. Ent. Fr. 5: 461.
1882 *Halictus scabrosus* Prov. ♂, Nat. Can. 13: 200.
1882 *Sphecodes dichroa* Prov. ♀, Nat. Can. 13: 257.
1883 *Halictus scabrosus* Prov. ♂, Faun. ent. Can. Hym. p. 700.
1883 *Sphecodes dichroa* Prov. ♀, Faun. ent. Can. Hym. p. 724.
1904 *Sphecodes dichrous* Ckll. Can. Ent. 36: 304.

SPHECODES EUSTICTUS Ckll.

1906 *Sphecodes eustictus* Ckll. ♀, Can. Ent. 38: 162.

SPHECODES FORTIOR Ckll.

1898 *Sphecodes fortior* Ckll. ♂, Bull. Denison Univ. 11: 44.

SPHECODES FRAGARIAE Ckll.

1903 *Sphecodes fragariae* Ckll. ♀, Trans. Am. Ent. Soc. 24: 98.

SPHECODES HERACLEI Robt.

1897 *Sphecodes heraclei* Robt. ♀, Trans. Ac. Sci. St. Louis, 7: 318.
1903 *Sphecodes heraclei* Robt. ♀ ♂, Ent. News, 14: 105–6.

SPHECODES HESPERELLUS Ckll.

1904 *Sphecodes hesperellus* Ckll. ♀ ♂, Can. Ent. 36: 232.

var. PULSATILLAE Ckll.

1906 *Sphecodes hesperellus* var. *pulsatillae* Ckll. Ann. Mag. Nat. Hist. ser. 7, 18: 75.

SPHECODES ILLINOIENSIS Robt.

1897 *Sphecodes pycnanthemi* Robt. (in part), ♀, Trans. Ac. Sci. St. Louis, 7: 320.
1903 *Machaeris illinoensis* Robt. ♀, Ent. News, 14: 107.

SPHECODES KINCAIDII Ckll.

1898 *Sphecodes kincaidii* Ckll. ♀, Proc. Ac. Nat. Sci. Phil. 1: 56.

SPHECODES KNETSCHI Ckll.

1898 *Sphecodes knetschi* Ckll. ♀ ♂, Trans. Am. Ent. Soc. 25: 186.

SPHECODES LEPTANTHI Ckll.

1904 *Proteraner leptanthi* Ckll. ♂, Ent. 37: 232.

SPHECODES MANDIBULARIS Cr.

1872 *Sphecodes mandibularis* Cr. ♀, Trans. Am. Ent. Soc. 4: 250.
1888 *Sphecodes mandibularis* Prov. ♀ ♂, Add. faun. Can. Hym. p. 335.
1897 *Sphecodes mandibularis* Robt. ♀ ♂, Trans. Ac. Sci. St. Louis, 7: 317.
1903 *Sphecodium cressonii* Robt. ♀ ♂, Ent. News, 14: 106.

Sphecodes minor Robt.

1898 *Sphecodes minor* Robt. ♀, Trans. Ac. Sci. St. Louis, 8: 45.

Sphecodes olympicus Ckll.

1904 *Sphecodes olympicus* Ckll. ♀, Can. Ent 36: 230.

Sphecodes pecosensis Ckll.

1904 *Sphecodes pecosensis* Ckll. ♀, Ent. 37: 5.

Sphecodes perlustrans Ckll.

1898 *Sphecodes perlustrans* Ckll. ♀, Bull. Denison Univ. 11: 45.
1899 *Sphecodes perlustrans* Ckll. Can. Ent. 31: 256.

Sphecodes pimpinellae Robt.

1900 *Sphecodes pimpinellae* Robt. ♀, Trans. Ac. Sci. St. Louis, 10: 51.
1903 *Sphecodium pimpinellae* Robt. ♀ ♂, Ent. News, 14: 106.

Sphecodes pycnanthemi Robt.

1897 *Sphecodes pycnanthemi* Robt. ♀, (in part), Tr. Ac. Sci. St. Louis, 7: 320.
1903 *Sphecodium pycnanthemi* Robt. ♀, Ent. News, 14: 106.

Sphecodes rhois Ckll.

1904 *Proteraner rhois* Ckll. ♂, Ent. 37: 233.

Sphecodes semicoloratus Ckll.

1897 *Halictus semicoloratus* Ckll. ♀, Trans. Am. Ent. Soc. 24: 168.
1898 *Sphecodes semicoloratus* Ckll. Trans. Am. Ent. Soc. 25: 186.

Sphecodes smilacinae Robt.

1897 *Sphecodes smilacinae* Robt. ♀, Tr. Ac. Sci. St. Louis, 7: 317.

Sphecodes sophiae Ckll.

1898 *Sphecodes sophiae* Ckll. ♀, Bull. Denison Univ., 11: 44.
1904 *Sphecodes sophiae* Ckll. Ent. 37: 232.

Sphecodes stygius Robt.

1893 *Sphecodes stygius* Robt. ♀ ♂, Trans. Am. Ent. Soc. 20: 145.
1897 *Sphecodes stygius* Robt., Trans. Ac. Sci. St. Louis, 7: 317.
1903 *Machaeris stygia* Robt. ♀ ♂, Ent. News, 14: 107.

Sphecodes sulcatulus Ckll.

1906 *Sphecodes sulcatulus* Ckll. ♀, Bull. Am. Mus. Nat. Hist. 22: 426.

Sphecodes ranunculi Robt.

1897 *Sphecodes ranunculi* Robt. ♀ ♂, Trans. Ac. Sci. St. Louis, 7: 318.
1903 *Proteraner ranunculi* Robt. ♀ ♂, Ent. 14: 105.

SPHECODES VEGANUS Ckll.

1904 *Sphecodes veganus* Ckll. ♀, Ent. 37: 5.

SPHECODES WASHINGTONI Ckll.

1904 *Sphecodes washingtoni* Ckll. ♀, Can. Ent. 36: 231.

MEXICO.

SPHECODES ASPERICOLLIS Sichel.

1865 *Sphecodes aspericollis* Sichel, ♀ ♂, Ann. soc. ent. Fr. 5: 457.

SPHECODES BASALIS Sichel.

1865 *Sphecodes basalis* Sichel, ♂ (var.), Ann. soc. ent. Fr. 5: 460.

SPHECODES METANOTIAEUS Sichel.

1865 *Sphecodes metanotiacus* Sichel, ♂, Ann. soc. ent. Fr. 5: 460.

SPHECODES METATHORACICUS Sichel.

1865 *Sphecodes metathoracicus* Sichel, ♂, Ann. soc. ent. Fr. 5: 456.

SPHECODES PILOSULUS Smith.

1879 *Sphecodes pilosulus* Sm. ♀ ♂, Des. New. Sp. Hym. p. 28.

SPHECODES PUNCTICOLLIS Sichel.

1865 *Sphecodes puncticollis* Sichel, ♀, Ann. soc. ent. Fr. 5: 459.

SPHECODES SUBCONFERTUS Sichel.

1865 *Sphecodes subconfertus* Sichel, ♀ ♂, Ann. soc. ent. Fr. 5: 455

ISLAND OF ST. VINCENT.

SPHECODES NIGRITUS Ashm.

1900 *Sphecodes nigritus* Ashm. ♂, Trans. Ent. Soc. Lond. 2: 221.

SPHECODES SOLITARIUS Ashm.

1900 *Sphecodes solitarius* Ashm. ♂, Trans. Ent. Soc. Lond. 2: 221.

SPHECODES THORACICUS Ashm.

1900 *Sphecodes thoracicus* Ashm. ♀ ♂, Trans. Ent. Soc. Lond. 2: 222.

In "Synopsis of Sphecodinae" (Ent. News, 14: 103) Mr. Charles Robertson has proposed to divide the local species of *Sphecodes* of Carlinville, Illinois, into the following genera: *Dialonia, Drepanium, Machaeris, Proteraner, Sphecodium,* and *Sphecodes* sens. str.

PSYCHE

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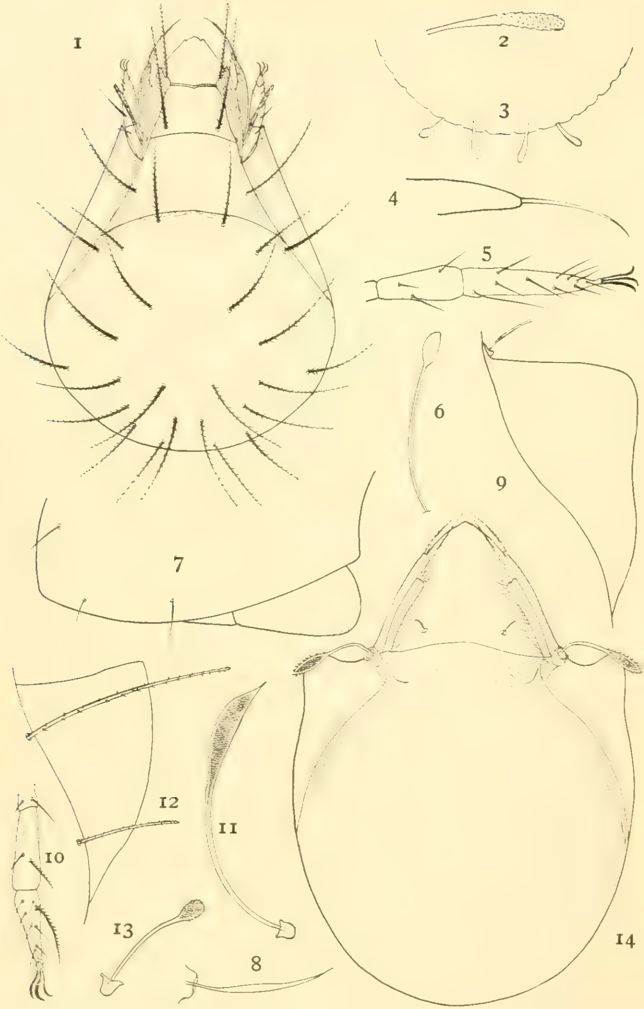

H. E. E. Del.

EWING : NEW ORIBATIDAE.

NEW ORIBATIDAE.

BY H. E. EWING, URBANA, ILLINOIS.

THE present paper describes seven new species of Oribatidae, including a species of *Pelops*, the first of its genus to be described from this country. Type specimens have been deposited in the Illinois State Laboratory of Natural History.

Pelops americanus n. sp.

Figs. 2, 3, 4.

Dark brown; integument of medium thickness and covered with small pits.

The cephalothorax is about one-third as long as the abdomen. A long process, one-half as broad as long, extends from the anterior margin of the abdomen to beyond the tip of the rostrum. A pair of large, spatulate, serrate bristles is situated on the posterior dorsal part of the cephalothorax; they project almost to the tip of the rostrum and diverge from the median plane. Lamellae situated laterally; about one-half as long as the cephalothorax, curving toward the median plane and ending in a sharp point, from which extends a simple, curved, bristle almost as long as the lamella itself.

Abdomen about as broad as long. Two pairs of short spatulate bristles are situated on the posterior margin near the median plane. The inner and upper two incline slightly toward the median plane. The outer and lower two incline markedly away from the median plane. There are two pairs of similar dorsal bristles and a lateral pair of bristles situated about half way from the anterior to the posterior margin of the abdomen. Pteromorphae large, about four-fifths as long as the abdomen and extending forward to about the middle of the cephalothorax. Genital covers larger than the anal covers and situated about their length in front of the latter. Anal covers situated one and one-half times their length from the posterior margin of the abdomen and two-thirds their length from the posterior margin of the ventral plate.

Legs rather small; unguis tridactyle; tibia and tarsus of leg IV subequal.

Length, 0.60 mm.; breadth, 0.45 mm.

In moss. Collected by myself at Batavia, Ill. One specimen.

Oribata clavilanceolata n. sp.

Figs. 9, 10, 11.

Light brown; integument thin and brittle, slightly pitted around the margin of the abdomen.

Cephalothorax about one-half as long as the abdomen; lamellae long and narrow, three-fourths as long as the cephalothorax; no translamellae; a pair of small lateral lamellae extend two-thirds the distance to the tip of the rostrum, each lamella ending in a long curved bristle; pseudostigmatic organ with a long, recurved peduncle and an enlarged head, which tapers to a fine point; interlamellar hairs erect; palpi prominent.

Abdomen about two-thirds as broad as long; pteromorphae truncate, not extending beyond the anterior margin of the abdomen, but extending backward to about the middle of the abdomen. Abdomen hairless; anal covers large and situated about one-half their length from the posterior margin of the abdomen; genital covers about one-half as long as the anal covers, and situated about twice their length in front of the same.

Anterior pair of legs almost as long as the abdomen, the femur being the largest segment; tibia of leg I slightly longer than the tarsus. The legs bear a few, large, curved, dentate bristles. Unguis tridactyle.

Length, 0.70 mm.; breadth, 0.35 mm.

Under stones. Collected by myself at Batavia, Illinois. Many specimens.

Oribata clavipectinata n. sp.

Fig. 14.

Brown; integument of medium thickness, surface somewhat rough.

Cephalothorax about one-half as long as the abdomen; lamellae without cusps and two-thirds as long as the cephalothorax and of about the same width throughout their length; no translamellae; lamellar hairs slightly pectinate and as long as the lamellae themselves; interlamellar hairs two-thirds as long as the lamellar hairs and directed away from the median plane; lateral lamellae small, narrow, each bearing a long, curved bristle, as long as the lamellae themselves. The pseudostigmatic organ is about as long as the lamellae, is recurved and has a moderately long peduncle and a long, clavate, pectinate head.

The abdomen is about three-fifths as broad as long; the pteromorphae are attached to the anterior half of the lateral line; they are truncate in front and extend a little beyond the anterior margin of abdomen. The abdomen is hairless.

The legs are of moderate size, the femur being the largest segment. Unguis tridactyle.

Length, 0.60 mm.; breadth, 0.42 mm.

In moss. Collected by myself at River Forest, Illinois. A few specimens.

Oribata curva n. sp.

Figs. 5, 6.

Dark brown; integument thick and resistant.

Lamellae small and situated laterally; pseudostigmatic organ very long, almost twice as long as the tibia of leg I; recurved, with a long, narrow peduncle and a very large, subglobose head.

Cephalothorax with a pair of lateral hairs about half as long as the cephalothorax itself, curved, and extending slightly beyond the tip of the rostrum.

Abdomen subglobose with a few small hairs; pteromorphae very large, almost as long as the abdomen, extending nearly to the tip of the rostrum and rounded in front. Anal covers slightly larger than the genital covers and situated about their length behind the latter. Ovipositor large, its proximal segment about as long as leg I. The ovipositor when extended is as long as the mite; the three subequal distal forks are each about as long as the segment stalk from which they extend.

Legs rather small; tarsus of leg I longer than the tibia; tibia with an apical bristle about as long as the segment itself; femur of leg I subglobose. Unguis tridactyle.

Length, 0.40 mm.; breadth, 0.30 mm.

Under old logs. Collected by myself at Eola Junction, Illinois. A few specimens.

Oribata multipilosa n. sp.

Fig. 1.

Light brown; integument of moderate thickness; surface slightly rough.

Cephalothorax rather long; lamellae prominent, situated laterally, about one-half as long as the cephalothorax and ending each in a short cusp; translamella a mere line. A pair of lateral lamellae is present also, these being very narrow and bearing each at its tip a long, curved, serrate bristle. Pseudostigmatic organs fusiform and almost as long as the lamellae. Lamellar hairs straight, pectinate and a little longer than the lamellae; inter-lamellar hairs similar to the lamellar hairs but longer.

Abdomen slightly longer than broad, bearing about two dozen large, conspicuous, dentate, bristles. Pteromorphae about as long as the cephalothorax but lying close to the body and projecting about one-half their length in front of the anterior margin of the abdomen. Genital covers smaller than the anal covers and situated about one and one-half times their length in front of the latter.

Legs small; unguis tridactyle.

Length, 0.75 mm.; breadth, 0.50 mm.

Under logs. Collected by myself at Eola Junction, Illinois. Several specimens.

Oribata serratoseta n. sp.

Figs. 12, 13.

Dark brown. Cephalothorax almost as broad as long; palpi prominent; lamellae narrow and about two-thirds as long as the cephalothorax; lamellar hairs straight, pectinate, and extending to the tip of the rostrum; interlamellar hairs about as long as the lamellar hairs; rostral hairs similar to the last, but curved. The pseudostigmatic organ has a small, recurved peduncle and a large, thick, subglobose head.

Abdomen two-thirds as broad as long, with many large, curved, serrate bristles. Pteromorphae short, triangular and two-thirds as broad as long, the anterior free margin being straight. Anal covers larger than the genital covers and situated one and one-half times their length behind the latter.

Legs large; tarsus and tibia of leg I subequal; tibia bearing a large bristle as long as the segment itself. Unguis tridactyle.

Length, 0.40 mm.; breadth, 0.30 mm.

In moss. Collected by myself at Eola Junction, Illinois. Three specimens.

Phthiracarus magnus n. sp.

Figs. 7, 8.

Dark brown; surface of integument smooth.

Cephalothorax about one-half as long as the abdomen. A pair of short curved bristles occurs close to the posterior margin of the cephalothorax and a similar pair of bristles is situated near the anterior end of the cephalothorax; pseudostigmatic organ narrow, lanceolate, and about two-thirds as long as tarsus I.

The abdomen is rounded posteriorly and bears dorsally about six bristles, and ventrally two pairs of prominent bristles lateral to the anterior and posterior margins of the anus respectively. Genital covers prominent, each bearing about six small hairs.

Legs of medium length; tarsus about twice as long as the adjacent tibia; tarsus and tibia of first two pairs of legs each bearing a long bristle, almost as long as the cephalothorax. Unguis tridactyle.

Length, 1.30 mm.; height, 0.80 mm.

Under old logs. Collected by myself at Pine, Ind. Seven specimens.

EXPLANATION OF PLATE.

Fig. 1. *Oribata multipilosa*, × 100.
Fig. 2. *Pelops americanus*, seta from the posterior dorsal part of cephalothorax, × 200.
Fig. 3. *Pelops americanus*, posterior margin of abdomen, × 110.
Fig. 4. *Pelops americanus*, lateral lamella, × 340.
Fig. 5. *Oribata curva*, tibia and tarsus of leg I, × 200.
Fig. 6. *Oribata curva*, pseudostigmatic organ, × 340.
Fig. 7. *Phthiracarus magnus*, ventral margin of abdomen, × 45.
Fig. 8. *Phthiracarus magnus*, pseudostigmatic organ, × 140.
Fig. 9. *Oribata clavilanceolata*, pteromorpha, × 200.
Fig. 10. *Oribata clavilanceolata*, leg II, × 108.
Fig. 11. *Oribata clavilanceolata*, pseudostigmatic organ, × 216.
Fig. 12. *Oribata serratoseta*, pteromorpha, × 260.
Fig. 13. *Oribata serratoseta*, pseudostigmatic organ, × 340.
Fig. 14. *Oribata clavipectinata*, × 134.

I would be glad to get material in the Noctuid genus *Homoptera* and its allies from all parts of the country for study in the preparation of a revision of this series. I will name and return specimens promptly, for the privilege of retaining such as may be needed in completing the work.

JOHN B. SMITH.

New Brunswick, New Jersey.

SOME EXPERIMENTS WITH HYBRIDS.

BY CAROLINE GRAY SOULE, BROOKLINE, MASS.

In 1906 I had many cocoons of larvae from *Cynthia* ♀ by *Promethea* ♂. In 1907 the moths emerged, and were hardly distinguishable from pure *cynthia*, though careful examination showed a duskier tint on the wings and a tendency toward the breaking into oblong patches of the inner marginal line on the hind wings. This however does not mean as much as the color difference, for some *cynthia* have the line more or less broken. The moths were as disappointing as the larvae had been, in following the *cynthia* marks so closely, and confirmed my belief that *cynthia* is prepotent in cross with any other species, though I have not been able to get moths from any other cross.

On May 30th, two pairs of the hybrid moths mated, the eggs hatched on June 19th, and the larvae lived through the third moult, dying, apparently from mere lack of vigor or "vitality."

On June 7th, two pairs mated, the eggs hatched on June 24th, and the larvae died in moulting for the third time.

On June 10th, two pairs were mated all night and until dark June 11th, but no eggs were laid. They remated on June 12th, no eggs being laid till June 15th. These hatched, the weather being very hot, on June 24th. The larvae died in moulting for the third time.

June 19th, one pair mated, but no eggs were laid.

The larvae were typical *cynthia* in looks, and very delicate. I had no ailanthus for them, but they ate wild cherry voraciously, preferring it to lilac or ash. Something was amiss with the cherry, in Tyson, Vt., this year, and I found several larvae of *promethea, polyphemus* and *excaecatus*, hanging from twigs limp and lifeless, just as my hybrids hung in my tins. Indeed I have never before found as many dead larvae as this year, and nearly all on wild cherry.

On May 19th, ♀ *polyphemus* mated with ♂ *promethea* for several hours, and laid many eggs which did not hatch.

May 22d, ♀ *promethea* mated with a ♂ hybrid (*cynthia* ♀ and *promethea* ♂) but laid no eggs.

May 23rd, ♀ hybrid mated with ♂ promethea, but laid no eggs.

May 27th, ♀ *cynthia* and ♂ cecropia mated, eggs were laid, and they remated on the 28th, more eggs were laid, but all were infertile.

May 27th, ♀ *R. jorulla* and ♂ *cecropia* mated; many eggs were laid but proved infertile.

May 28th, ♀ hybrid mated ♂ *promethea* but the many eggs were infertile.

May 30th, ♀ hybrid and *promethea*, no eggs.

" " ♀ *cecropia* and ♂ *jorulla*, many infertile eggs.

May 31st, ♀ hybrid mated ♂ *promethea* but the eggs failed to hatch.

June 3rd, another similar pair mated but no eggs were laid.

June 14th, ♀ *polyphemus* mated ♂ *promethea* and laid many eggs, infertile.

June 16th, ♀ *promethea* and small ♂ *cecropia* mated. Over 200 infertile eggs were laid, and the pair mated a second time. No eggs.

June 17th, another similar pair, with many infertile eggs.

June 17th, ♀ *promethea* mated ♂ hybrid, many eggs were laid; remated, and more eggs were laid, all infertile.

June 29th, ♀ *H. budleyi* and ♂ *cynthia* mated, a few infertile eggs were laid.

July 3rd, ♀ *cynthia* mated ♂ *budleyi*, many infertile eggs were laid.

June 19th, ♀ *jorulla* mated ♂ *promethea* and laid many infertile eggs.

June 20th, ♀ *jorulla* and ♂ *cecropia*. Many infertile eggs.

June 22d, ♀ *promethea* mated ♂ *jorulla* and laid infertile eggs.

June 23rd, ♀ *jorulla* mated ♂ *promethea* and laid many infertile eggs.

As in former experiments my results differ from Mr. Joutel's, in that my moths seem to mate more readily, and to oviposit, in most cases, more freely.

June 29th, ♀ *cynthia* mated ♂ *budleyi* and laid many eggs, two of which hatched on July 21st, but died before moulting.

July 3rd, ♀ *budleyi* and ♂ *cynthia* mated, a few infertile eggs.

July 9th, two pairs ♀ *cynthia* mated *promethea* ♂♂ attracted by a ♀ *promethea* near the window.

Fertile eggs resulted but the larvae died from the cherry.

July 18th, ♀ *promethea* mated ♂ *S. gordins*, apparently normally, and laid many infertile eggs.

From this experience I think that *cynthia* and *promethea* will mate any other species, and *cecropia* has mated with every species provided so far.

Polyphemus ♂♂ have been attracted to a dark window by ♀♀ of *cynthia*, *promethea*, and *cecropia* on several occasions, no ♀ of their own kind being in the room.

A REVIEW OF THE GENUS CHRYSOPHANUS.

BY KARL R. COOLIDGE, PALO ALTO, CALIFORNIA.

For some time the writer has been accumulating material in this genus with a view of monographing. Identifications of the various species of some genera of our *Rhopalocera* are often quite impossible, owing to the lack of necessary literature, so widely scattered. This is especially true in the west, where good entomological libraries are so rare. The writer believes that, if those who were working on any special genus or genera, would publish their results with the more important references, etc., our faunal knowledge would soon become much better known. In order to straighten out the present genus, the writer desires to obtain by purchase, exchange or loan, specimens of all our *Chrysophanids* from various localities. Immature stages, aberrations, minor variations, and specimens of *zeroe* and the *hypophleas* group, are especially desirable. The genus *Chrysophanus* is now divided into six genera, several more or less superficial, viz.: *Tharsalea, Gaeides, Chrysophanus, Epidemia, Heodes* and *Chalceria,* but for convenience in the following brief synopsis, the species are listed under the one genus.

1. *arota*, Boisd. This species is known, so far, only from California. It flies quite commonly in the vicinity of San Francisco Bay. It is closely allied to *virginiensis,* Edwards and may prove conspecific with it. Dyar has partially described the preparatory stages. The larva feeds on *Ribes*.

2. *virginiensis,* Edwards. Found at high altitudes in Colorado, Nevada and California. Common at Lake Tahoe. Nothing is known of the early stages.

3. *hermes*, Edw. *Hermes* is a rare species and is not very well known. It appears to be rather abundant at San Diego, California and is also reported from Nevada. Wright (Butterflies West Coast) redescribes it as *del-sud*, the specimens coming from the type locality.

4. *xanthoides*, Boisd. Another Californian species and the largest in North America. It was recently, however, discovered at Calgary, Canada. I have it from many localities in California and it is evidently widespread in its distribution there, occurring more commonly at fairly high altitudes. Boisduval, (Lep. de la Californie) writes "Montagnes de la Californie. Rare." Henry Edwards has described the egg.

5. *dione*, Scudder. Ranges from Iowa to Kansas, and is also found in Nebraska, Montana, Manitoba, and Colorado. It comes very close to *xanthoides*

and *editha*. The full-grown larva and pupa have been briefly described. The larva feeds on Rumex longifolius.

6. *editha*, Mead. Known from Oregon, California, Utah and Nevada. It is common at Lake Tahoe and is not rare in the vicinity of San Francisco Bay.

7. *gorgon*, Boisd. Occurs in Nevada and California. Mr. J. C. Grundel has briefly described the life history and he has kindly sent me a number of eggs. These are laid in the forks of a species of *Erigonum*. Usually but a single egg is deposited in a fork but sometimes as many as seven or eight are found, but are laid by different females. They are deposited in June or July and according to Mr. Grundel hatch the latter part of August, but those sent me have not hatched yet (October). The egg may be described as follows: Diameter about 1 mm.; color dirty creamy white. Hemispherical, flattened at base, marked by numerous prominent polygonal or semicircular depressions.

8. *thoe*, Boisd. A well known species, but the life history is still imperfect. It is found in the eastern states and I have specimens from New Mexico and Colorado.

9. *mariposa*, Reakirt. Recorded from Washington, Oregon, Montana, California, Colorado, British Columbia, and Canada. I have taken it commonly near Missoula, Montana. The larval food-plant is *Vaccinium*.

10. *zeroe*, Boisd. An uncommon, though well distributed, species. I have it from Colorado, Montana and Lake Tahoe. It is also found in Utah, Wyoming and Idaho. The females are much rarer than the males. There is considerable variation in the tinting on the underside of the secondaries.

11. *helloides*, Boisduval. Common throughout the west from Iowa and Illinois to Vancouver Island. The larva feeds on *Polygonum aviculare*.

12. *dorcas*, Kirby. This is an arctic form found in Alaska, British America, South Labrador and has also been reported from Michigan. Wright considers it a northern variety of *helloides*. The variety florus, Edw., is known only from Garrett's Ranch, British America.

13. *epixanthe*, Bd.-Lec. Our smallest species, ranging from Newfoundland to Vancouver.

14. *hypophleas*, Boisd. Common in the Atlantic States. The aberration *fasciata*, Strecker, has the transverse rows of spots on primaries much enlarged, and blended together to form an irregular band. The variety *fulliolus*, Hulst, has the coppery reddish color replaced by a glowing somewhat sooty yellow. I am not acquainted with the var. *feldeni*, McLach., which is recorded from Arctic America. The preparatory stages have yet to be fully worked out.

15. *phlaeas*, Bd.-Lec. A European species, which has been reported from Alberta.

16. *arethusa*, Dod. Described recently from Calgary, Canada. It is probably the western variety of *hypophleas*.

17. *cupreus*, Edw. Very rare, known only from Mt. Shasta and Oregon.

18. *snowi*, Edw. Occurs in Colorado, British America and Alberta, at high altitudes. In Colorado the food plant is *Oxyria digyna*.

19. *rubidus*, Edw. Flies in Utah, Nebraska, Oregon, Nevada and Montana. The var. *sirius*, Edw., is said to range from Montana to Arizona and to Ft. McCleod, British America. I have many specimens from Colorado.

A NEW LOCUSTID FROM NANTUCKET.

BY H. T. FERNALD, PH. D., AMHERST, MASS.

Five days of collecting on Nantucket Island from the fifth to the tenth of last September brought to light several interesting insects, among them being a nymph of *Dissosteira carolina* in which the front and rear margins of the pronotum are turned upward giving the plate much the appearance of a riding saddle. One day while collecting back of the town near the old cemetery I also noticed a green locustid, entirely brachypterous, which nevertheless had its well developed ovipositor so firmly wedged into a somewhat weathered board forming one rail of a fence that it required some force to extract it. On another day while collecting within a mile of this place a brachypterous male and a partly brachypterous female were captured and placed in my boxes.

Recently through the kindness of Prof. A. P. Morse of Wellesley I learn that though the partly winged specimen last named is an immature *Scudderia* the other two are *Leptophyes punctatissima* Bosc. which he states has never before been reported from this country though well known in Europe. There can be no doubt of the correct determination of these insects as Prof. Morse compared them with European specimens in the Scudder collection. The specimens are now in Prof. Morse's collection.

How this species reached Nantucket and how long it has occurred there can probably only be topics for speculation, but as little attention was paid to the Orthoptera in collecting it would seem probable that it is at least fairly common there.

GEOMETRID NOTES.— ON MESOLEUCA CAESIATA.

BY L. W. SWETT, MALDEN, MASS.

As I looked through the Packard collection at Cambridge, Mass., I noticed that his eastern types of *Mesoleuca caesiata* Denis & Schiffermüller were not like the European ones of his own or my collection. *Mesoleuca caesiata* in Packard's European collection numbered some 12 or 15 examples from Staudinger and others, the localities being Lapland, Iceland, Switzerland and Austrian Alps. His American examples were from Okak and Caribou Islands, also Mt. Washington, Aug. 1–11, and specimens from Randolph, Vt., in the Boston Society of Natural History. In the Proc. Bost. Soc. Nat. Hist., Vol. XI, 1866, page 51, he described *Cidaria aurata* from Okak, Caribou Islands and Mt. Washington, N. H. He speaks of these as having golden scales on the fore wings and on examining the types I found they agreed with the original descriptions but not with the European forms. Thus I saw we had two distinct species of which I note the following.

In *caesiata* European, the hind wings are whitish with traces of brown markings, the fringe of both wings being black and white. In some the markings are sharp and well defined, being powdered with golden scales. The discal spot is plain and distinct, there being a white and black cast to all wings. In *caesiata*, American form, or *aurata*, the specimens are of a brownish cast, smoky as it were and not black and white like the European. The hind wings lack the pallid white of true *caesiata* and are suffused with brown, and there are two white wavy zig-zag lines with brown margins to wings. The discal spot is suffused and the center of the mesial band is not clear, like European, but smoky and divided though not gray as some Iceland examples or reddish brown as my European examples from Pitcarpel. *Mesoleuca flavicincta* of Europe is a closely allied form to *aurata* but is so distinct as not to allow discussion. The variety *Mesoleuca inventaria* of Grote (Bull. Geol. Surv. Terr. Hayden VI, 591, 1882), may be a synonym of this but as I have not seen the type I can not say. While working over this matter last February, I wrote to Dr. Taylor in regard to the western forms, as they were unknown to me; and he assures me that they are the same as Eastern, though I believe he did not have the description as he did not then possess a copy of the description in the Boston Society Papers, for which he wrote afterwards. No doubt we shall have an interesting paper from him on the western form.

THE MALLOPHAGAN PARASITES OF THE KEA.

BY VERNON L. KELLOGG, STANFORD UNIVERSITY, CAL.

THE notorious sheep-destroying parrot of New Zealand, the Kea (*Nestor notablis* Gould), has not hitherto been examined to see what, if any, parasites help to make life troublesome for it as itself works misery for the New Zealand flocks. The Kea feeds on carrion mostly, but has also the deplorable habit of alighting on a sheep's back and tearing away the flesh until it gets at the kidney fat, which it eats with depraved relish. It then flies away, leaving its unfortunate victim to suffer until death mercifully comes to it.

Specimens of Mallophaga sent me by Mr. D. L. Van Dine, Entomologist of the U. S. Experiment Station at Honolulu, obtained by him from Mr. Brigham, Director of the Bishop Museum, show that Kea has some troubles of its own. In a vial of Mallophaga collected from the Kea in New Zealand there are three species of these parasites representing the genera *Lipeurus*, *Colpocephalum* and *Menopon*. All of these can be referred to already described species but curiously enough only one of them is a species typical of parrots, the other two being recorded only from true raptorial birds.

Lipeurus circumfasciatus Piaget, var. *kea* Kellogg. Males and females from the Kea, *Nestor notabilis* (New Zealand). Differs from the species type in the much larger size and the absence of even the slightest angular projection on 3rd segment of the male, and the presence of a distinct, although small, lateral projection on the 4th segment. Male, length, 2.30 mm., width .6 mm., female length 3 mm., width .61 mm.

Colpocephalum setosum Piaget. Several females from the Kea, *Nestor notabilis* (New Zealand). Differs markedly from any Colpocephalum so far described from parrots and is undoubtedly identical with Piaget's *C. setosum* described from the vulture, *Cathartes gryphus* (Zool. Garden of Rotterdam).

Menopon fulvofasciatum Piaget var. *kea* Kellogg. Three adult males and several young from a Kea, *Nestor notabilis* (New Zealand). Although differing in some details and a little larger than the type these specimens can probably be referred to Piagets' *M. fulvofasciatum* described from *Buteo vulgaris*. The Kea specimens are certainly unlike any Menopon previously recorded from the parrots. The differences which distinguish the Kea specimens from typical *fulvofasciatum* are the additional spines in lateral angles of prothorax, a difference in the ninth abdominal segment which is *not* abruptly distinguished from the eighth as in the species type, the more strongly colored lateral ends of the transverse abdominal blotches, and the slightly larger size, the males being fully 2 mm., long, while *fulvofasciatum* is recorded as but 1.6 mm. in length (male).

THE HEMIPTERA OF JAMAICA.

NOTES ON JAMAICAN HEMIPTERA: A Report on a Collection of Hemiptera made on the Island of Jamaica in the spring of 1906. By E. P. Van Duzee (Bull. Buffalo Soc. Nat. Sci., VIII, No. 5, 1907). Our knowledge of the Hemiptera of Jamaica is greatly increased by this valuable paper, in which are recorded 236 with notes on distribution, etc. Of the above number 85 were new to science, the author describing about 54 species while the remainder belonging to the family Capsidae were described by Dr. O. M. Reuter in the Of. Finsk Vet-Soc. Forhandl., XLIX, No. 5, 1907. The author is to be congratulated on doing such a splendid month's work under adverse climatic conditions. It clearly shows the value of specialization. The locality Rivington, N. J., on pages 24 and 69 should read 'Riverton.'

C. W. J.

The four-color process plate which appeared in the October number was made by the Sparrell Print of Boston. The Editors wish to make acknowledgment of their indebtedness to that establishment for friendly assistance in the design of the plate, and scrupulous care in its production.

ERRATA.— Readers of PSYCHE are requested to make corrections as following in the articles by Mr. A. A. Girault as printed in the current volume:
Hosts of Insect Parasites.
XIV, 1907, p. 30, 4th line from bottom, *Trissoleus* read *Trissolcus*.
p. 37, 15th line from bottom, *Townsend* read *Townend*.
last line, *Chales* read *Charles*.
p. 38, 8th line from bottom, *Drew* read *Dru*.
p. 39, 7th line *Catalogs* read *Catalogus*.
Colorado Potato Beetle.
p. 47, 3rd paragraph, *cruciform* read *cruciform*.
p. 52, line 4, *is* read *its*.

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